CANADIAN ELECTRONICS ENGINEERING

AUGUST 1959
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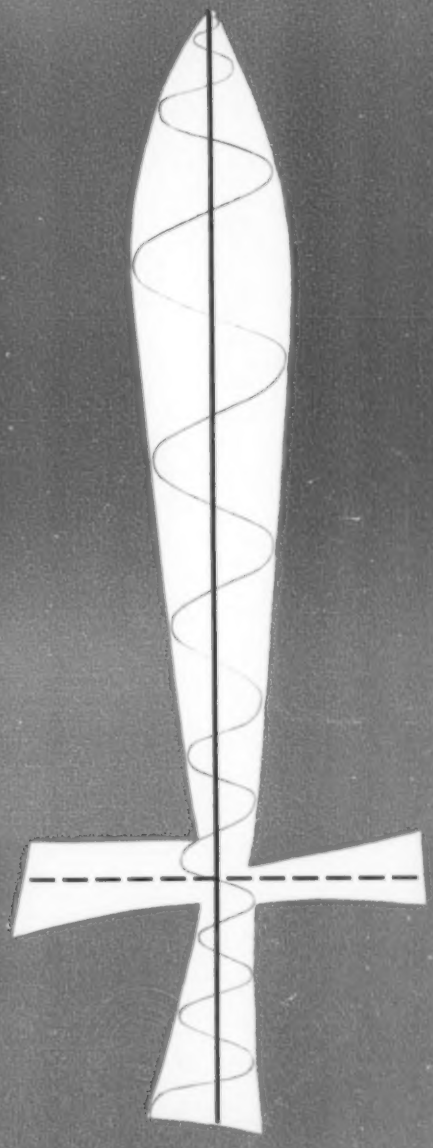
five dollars a year

AUG 12 1959

Canadian electronic resources for integrated defense production



VARIAN provides MANUFACTURING-DEVELOPMENT-RESEARCH

VARIAN's record for reliability, performance, and quality is the highest in the field

Varian Associates of Canada Ltd. was incorporated in October 1954 for the purpose of providing a Canadian manufacturing source for the world famous Varian klystron tubes. The company is a subsidiary of Varian Associates, Palo Alto, California, which was founded in 1948 by Russell H. and Sigurd F. Varian, who pioneered the klystron in 1937.

Designing and producing top quality klystron tubes and microwave circuitry for microwave communications, navigation systems, radar and guided missile applications is a highly complex undertaking. It requires experienced engineers and skilled technicians coupled with extremely precise inspection and quality control measures to achieve uniformity and reliability.

Over 25 different tube types are now in production at our Georgetown plant.

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OFFICE OF THE PRIME MINISTER · CABINET DU PREMIER MINISTRE · CANADA

I am pleased that Canadian Electronics Engineering is publishing this special edition to emphasize the scope and potential of technical manufacturing facilities in this country.

This is an age of specialization and I am sure the crafts and professional abilities of Canadians can contribute much to the industrial strength of all North America. Maximum defence security cannot be attained today by any nation standing alone. Without co-operation between friendly nations there is no survival, and it is on this basis that Canada and the United States are working together with other members of the North Atlantic Treaty and in the North American Air Defence establishment.

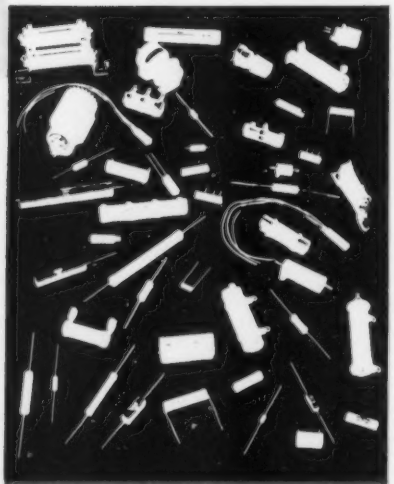
Canada is ready at all times to make available its resources and its skills for joint development and mutual security.

Prime Minister.

O t t a w a,
1 9 5 9.

The NEW CERL-DALE, Limited

now serving Canada with the FINEST of RESISTORS



Canadian electronic manufacturers now have a superb source for the finest of precision resistance products.

Formation of CERL-DALE, Limited (formerly Canadian Electrical Resistors, Limited), makes available through a Canadian company the dependable DALOHM line of resistors and trimmer potentiometers.

CERL-DALE, Limited, is a single source for wire wound, deposited carbon, vitreous enamel and metal film precision resistors. Inherent stability is achieved by advanced component design and manufacturing techniques. Both wire wound and carbon trimmer potentiometers in numerous sizes and styles can now be ordered.

In addition to the DALOHM line, all of the famous CERL and BERCO products will continue to be available.

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Curity Avenue
Toronto 16, Canada

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August, 1959

CANADIAN ELECTRONICS ENGINEERING

Volume three, number 8

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cover design

Art director Frank Davies visualized this special issue as a bold approach to a difficult and important problem. His cover reflects that bold approach.

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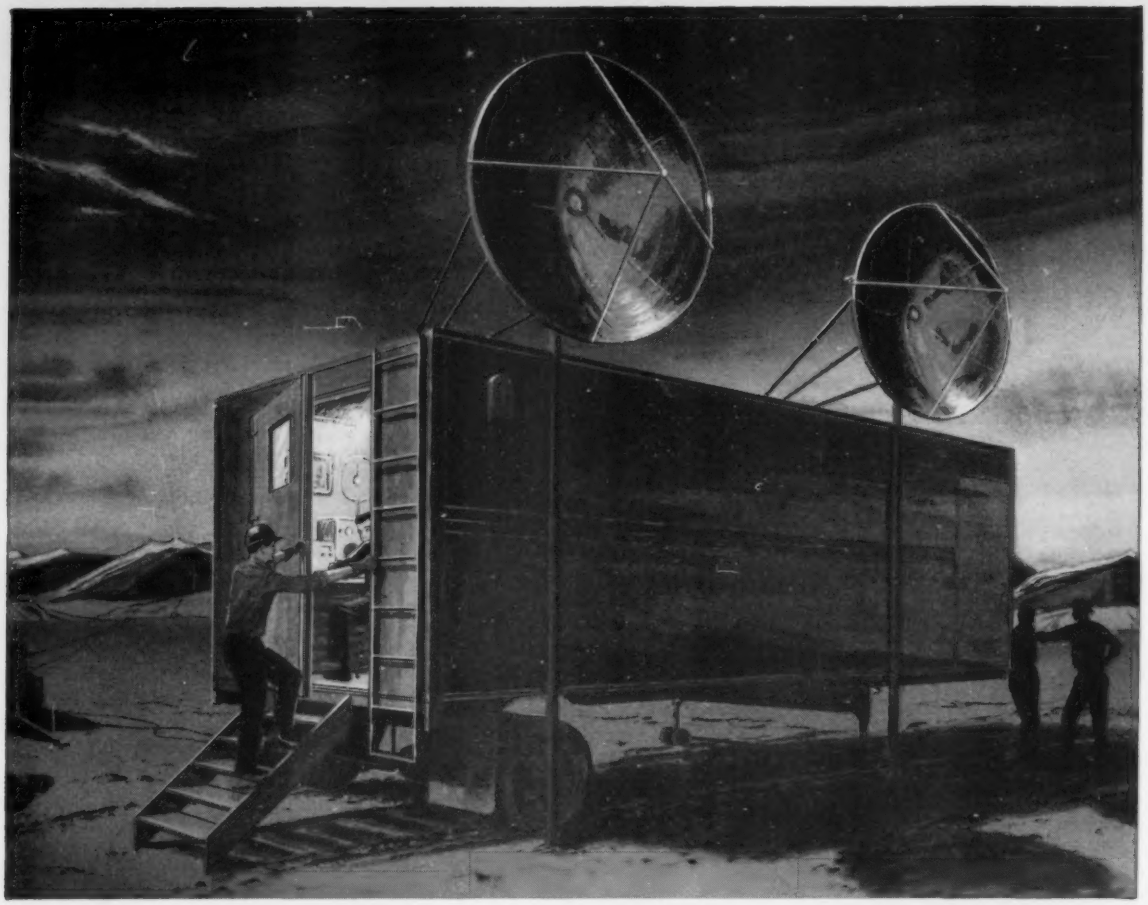

NEW TROPO SCATTER SYSTEMS

can be set up anywhere in 8 hours or less!

A new, transportable communication system has been developed by Canadian Westinghouse for sending two-way voice or teletype messages up to 200 miles *without* relay stations.

Its name is MICROSCATTER—the most *compact* system ever developed for low-cost, long range tropospheric scatter communications.

Now in production for customer orders, MICROSCATTER radio is a super high frequency system that can go *anywhere*. MICROSCATTER transmitters and receivers for quadruple diversity, including antennas, can be mounted in a standard 30 ft. truck trailer. Units designed for self-contained field shelters can be set down by helicopter in remote locations—and a MICROSCATTER installation can be set up ready for operation within 8 hours!

MICROSCATTER APPLICATIONS

COMMERCIAL	MILITARY
Fixed Station —120 telephone channels —television and sound	Wide Band —radar —data —120 telephone channels
Transportable—48 telephone channels —teletype	Tactical and Transportable—48 voice channels —teletype —data

FEATURES

- Frequency—4400-5000 mc
- Antennas—10 to 28 ft. diameter
- Power—2 KW
- Range—100 to 200 miles

A Westinghouse communications specialist will gladly furnish complete information on MICROSCATTER radio. Phone your nearest Westinghouse office, or write to Canadian Westinghouse Company Limited, Electronics Division, Hamilton, Canada.

YOU CAN BE SURE... IF IT'S Westinghouse

39A745

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Rt. Hon. John G. Diefenbaker
Prime Minister of Canada

contributors and special articles in this issue:

Many people and companies have contributed valuable information for this special issue on integrated defense production. **Prime Minister Diefenbaker** sums up the defense situation very well in his message reproduced on page 1.

D. A. Golden, Deputy Minister, Department of Defence Production, explains the history and principles of the production sharing program. He then tells how DDP, the Canadian Commercial Corp. and U. S. Government agencies have been working together to implement the policies, and what the Canadian industry must do if it wants to share in defense electronics production.

S. D. Brownlee has made two contributions to this special issue. As president of Canadian Admiral Corp. Ltd., he submitted information about his company; as president of the Electronic Industries Association of Canada, he urges Canadian companies to get out and do more selling. His story is on page 38.

To show how Canadians and Americans have been working together very successfully on defense projects, **Dr. J. E. Hogarth** (Canada and U. S. pool talents for research project) tells the story of the Prince Albert Radar Laboratory. Dr. Hogarth, a graduate of Engineering Physics from the University of Toronto, has been with Defence Research Board since 1950. While on loan to the Royal Military College of Science, he took his doctorate in theoretical physics at London University.

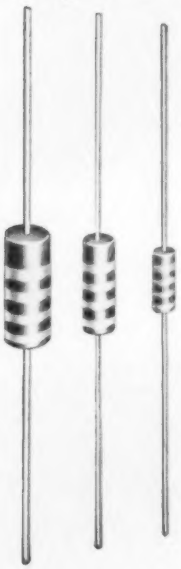
After doing research work on radar techniques for the Mid-Canada line, Dr. Hogarth was appointed Canadian Scientific Liaison Officer at Lincoln Lab. and USAF Cambridge Research Centre. In 1957 he returned once more to Ottawa to take charge of the DRTE section responsible for PARL and other radar propagation research being carried out in the Ottawa area.

Finally, the management of almost every electronics manufacturing company in Canada co-operated in supplying information for this special issue. The staff of CEE wish to thank all these people for their wholehearted co-operation.

Brownlee

Hogarth

how many Resistors have you soldered recently?



It's no trick today to obtain resistors that give everything you need in the way of conventional characteristics such as load life, resistance-temperature, temperature cycling, and so on.

But what a whale of a difference when it comes to "solderability"! Try the different makes for yourself and see. Whether you solder by hand or by automatic dipping, you'll find that Stackpole Coldite 70+ resistors solder lots better, lots faster and lots more surely.

Just hit 'em with solder and they stay soldered—because they're the only resistors whose leads get an extra final solder dip *in addition* to the usual tin-lead coating. You get faster production, fewer rejected assemblies. And there's less chance of trouble developing after your products reach the field.

COMPARE THESE "SPECS"! — Write for Stackpole Resistor Bulletin giving complete scorecard for Coldite 70+ (cold-molded) resistors in relation to MIL as well as commercial specifications. And remember that they give you unmatched solderability in the bargain—at no extra cost!

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Ceramag® ferromagnetic cores • Slide and Snap switches • Variable composition resistors **Ceramagnet®** ceramic magnets • Fixed composition capacitors • Electrical contacts Brushes for all rotating electrical equipment Hundred of related carbon, graphite, and metal powder products.

STACKPOLE
Coldite 70®+
fixed composition resistors

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Taylor becomes director and vice-president of Aviation Electric

Last month **D. R. Taylor** was elected to the board of directors and appointed vice-president of Aviation Electric Ltd. Mr. Taylor is a graduate electrical engineer (McGill University) and has spent his entire career in the aviation industry. He joined the company in 1952 and has held the position of sales manager and director of the engineering products division. In his new position, Mr. Taylor will continue to head the activities of the engineering, manufacturing, sales and service departments in addition to his new duties as vice-president.

Distributor sales specialist

In the electronic tube section of Canadian General Electric Co. Ltd., **William J. Stead** has been appointed specialist-distributor sales. He will work with GE tube distributors and district sales managers in the development and application of sales programs for replacement tubes. For the past several years Mr. Stead has been the tube specialist at the Ottawa district office of CGE.

Canada Wire vice-president

Canada Wire and Cable Co. Ltd. has appointed **J. H. Stevens** as vice-president, co-ordinating sales and engineering. Mr. Stevens, a graduate in engineering physics, is a member of the Association of Professional Engineers of Ontario.

Automatic Electric appointments

Two staff appointments have been announced for the Vancouver office of Automatic Electric Sales (Canada) Ltd. **G. R. Morrow** has been appointed district manager, responsible for all company operations in the Pacific district, covering B. C. and the Yukon.

G. H. K. Begg has been appointed Pacific district sales manager, responsible for all sales activities in that territory.

Collins Radio promotes three staff members

At Collins Radio Co. of Canada Ltd. **Frederick W. Preziosi** has been appointed chief engineer, **Robert W. Hipwell** has been appointed director of material, and **Lorne O. Lawler** has been appointed purchasing agent.

Mr. Preziosi joined Collins Radio Co. of Canada in 1955. He is a graduate of McGill University and had prior experience on communications equipment with Standard Telephones and Cables Mfg. Co. (Canada) Ltd.

Mr. Hipwell graduated from the University of Toronto in 1944 and was commissioned in the Royal Corps of Signals. After the war he served as an industrial engineer, then joined Collins Canada in 1956.

Mr. Lawler, a graduate of the Radio College of Canada, and a former employee of Canadian General Electric Co. Ltd., has held various positions in the purchasing department since joining Collins Canada in 1955. During the war he served with Research Enterprises Ltd. and National Research Council.

Appointments at Philips Electronic Industries

D. H. Prentice has been elected vice-president of Philips Industries Ltd., a division of Philips Electronics Industries Ltd.

T. Van Dyk has been elected executive vice-president, and **F. H. Pounsett** has been elected vice-president, engineering and manufacturing (Radio and Television division), Philips Electronics Industries Ltd.

ASHLEY & CRIPPEN

Preziosi

BORIS

Hipwell

ASHLEY & CRIPPEN

Prentice

ASHLEY & CRIPPEN

Lawler

ASHLEY & CRIPPEN

Van Dyk

BATTEN

Pounsett

Honeywell sales manager

National sales manager, industrial division of Honeywell Controls Ltd. is now **G. H. (Jerry) Sedgley.** He replaces R. J. Bilodeau who has been appointed general manager of the industrial equipment division in Europe.

In his new position, Mr. Sedgley will direct and co-ordinate sales of all Honeywell industrial products across Canada, including Brown instruments, Heiland oscillographs, Davies tape systems and Rubicon instruments.

EATON'S

Taylor

Stead

Morrow

Begg

CHECK CLM for ...electrical components and equipment

- **SELENIUM RECTIFIER CELLS**—High current density (HCD) power types. Using special Vacuum process producing a cell having low losses and high efficiency.
- **SELENIUM RECTIFIERS**—Complete units operating on AC and producing various devised DC ratings. Units designed in all types of cabinets—relay rack mounting, wall mounting, floor cabinets and cubicles.
- **REGULATED SELENIUM RECTIFIERS**—Using specially designed transistorized regulating circuit to maintain DC voltage within ±1% from 5% to full load with line voltage variations of ±10%. These DC power plants are designed in many ratings from a few watts to several Kilowatts.
- **SELENIUM BATTERY CHARGERS**—Several types are available—manually operated, constant voltage regulated, filtered for talking circuits. Hi-Lo substation battery types.
- **SELENIUM BATTERY ELIMINATORS**—DC power supplies for small telephone exchanges suitably filtered and regulated for constant voltage.
- **TAPE RELAY CABINETS**—Special classified teleprinter type cabinets designed in conjunction with Engineers of Canadian Government.
- **TAPE WINDERS AND REELS**—Ruggedly designed to meet requirements of Military Teleprinter service.
- **TWO WAY AMPLIFIERS**—For Air Terminal use specially designed in conjunction with engineers of Canadian Government Department of Transport.
- **AIRPORT LIGHTING CONTROL**—Relay equipment in rugged outdoor cabinets for remote control of runway strips.
- **WATER HEATER CONTROL**—Carrier current control systems for removing water heaters and other off-peak loads from power systems reducing the peak demand on the system. Also controls street-lighting.
- **HIPOT COUPLERS**—For synchronizing and voltage indication as well as voltage charge alarm on Power systems.
- **HIPOT PHASING STICKS**—A simple, fast and safe method of phasing, phase rotation and determining whether line alive or dead on power systems.
- **RELAYS**—Various types and sizes of telephone relays both standard and plug-in, as well as small power type relays.

For more complete information, write or contact: Mr. Jack West, P. Eng., Product Manager, Rectronic Division, Canadian Line Materials, Toronto 13, Canada.

CLM

CANADIAN LINE MATERIALS

Toronto 13, Canada

DIVISION OF McGRAW-EDISON COMPANY (CANADA) LIMITED

McGRAW EDISON

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West German Air Force orders CDC navigation system

A large order for an automatic dead reckoning navigation system has been secured by Computing Devices of Canada Ltd. from the West German Air Force. The contract, for some 250 sets, has been specified for the new Luftwaffe supersonic fighter —the Lockheed F-104 Starfighter. CDC was picked in the face of world competition.

J. R. Steacie, CDC project engineer, demonstrates two units of navigation system for West German Air Force.

Called PHI (Position Homing Indicator) the 24.5-lb. computer consists of a pilot's indicator, a push-button selector package, and an analog computer. Working on the principle of dead reckoning, it computes where it is by remembering where it started and by keeping track of all course changes and speeds. The pilot's indicator is mounted in place of the compass to show the course and distance. Any one of five preset bases or destinations can be selected by the push of a button on the selector package. When a counter on the indicator reaches zero, the pilot knows he has arrived at his destination. Wind speed, direction, magnetic variation are automatically allowed for by the computer. Extra push-button packages may be fitted for greater choice of bases and targets.

Work on PHI began in 1952 for the RCAF and the latest version—Mk 4 —has been test-flown for some time. Although no official price has been given, the cost of each set is estimated at about $20,000.

AEI announces Canadian company

Associated Electrical Industries of Britain announced that the staffs of the British Thompson-Houston Co. (Canada) Ltd. and Metropolitan-Vickers Export Co. Ltd.—both AEI companies—have been combined to operate under the name of Associated Electrical Industries (Canada) Ltd. The new firms will be responsible for selling and servicing products manufactured by AEI divisions in the U. K. and the AEI Switchgear factory in Montreal.

M. G. McHaffie, former managing-director of the British Thompson-Houston Co. (Canada) Ltd., was elected president. R. P. Horlock, former Canadian manager of Metropolitan Vickers Electrical Export Co. Ltd., became director and vice-president. Another AEI company, Siemens Edison Swan (Canada) Ltd. will continue to operate without change of name. H. T. Wormell, president of the Canadian firm, was named a director of Associated Electrical Industries (Canada) Ltd.

Britain's largest electrical company, AEI manufactures all types of equipment from small motors to 150,000 kw steam turbine generators. The announcement was made following the consolidation of a number of individual export organizations home-based in Britain that handled the firm's extensive activities. They were Metropolitan-Vickers Electrical Export Co. Ltd., The British Thompson-Houston Export Co. Ltd. and Siemens Edison Swan (Export) Ltd.

Wire plant in Halifax

Phillips Electrical Co. Ltd. is having a new factory built in Halifax. It will be used to produce plastic insulated telephone wires and cables, building wires and cables, polyethylene line wires, and ACSR. Opening of the new plant is scheduled for January, 1960.

New principals and representatives

Bristol Aero Industries Ltd., Winnipeg division, has been appointed exclusive sales representative in Manitoba, Saskatchewan and Alberta for Bendix airborne electronic equipment. Bristol's operations include electronic and radar facilities for overhaul, installation and calibration of airborne electronic equipment.

Microwave Systems, Scarborough, Ont., has been appointed representative for Technicraft Laboratories Inc., manufacturer of rigid and flexible waveguides and accessories.

A. C. Wickman Ltd., electronics division, has been appointed Canadian representative for Houston Instrument Corp., specialists in electromechanical instruments for research laboratories and for the petroleum and chemical industries.

Radionics Ltd. has been appointed exclusive Canadian representative for Julie Research Laboratories Inc., manufacturers of resistors and instruments. The firm has also become representative in Eastern Canada and Manitoba for Southwestern Industrial Electronics Co., division of Dresser Industries Inc. SIE products include transistorized signal generators, microsources, voltmeters and audio response plotters.

Desser E-E Ltd. has been appointed representative for Vis-U-All Products Co., manufacturer of tube testing equipment.

Atlas Wholesale Radio has been appointed distributor for Eastern Canada on the miniature and subminiature transistor transformer line of Microtran Co. Inc.

The Garlock Packing Co. has appointed **Lake Engineering Co. Ltd.** as their sole Canadian representative in the field of Teflon, Kel-F, nylon, and allied components and raw materials for electronic applications.

Electron Products Co., Pasadena, Calif., manufacturers of capacitors and interference filters, has appointed **Electromechanical Products,** Agincourt, Ont., as exclusive Canadian representatives.

Companies move to new premises

Ampex American Corp. has moved to 1458 Kipling Ave., Rexdale, Ont. Phone number is CH 7-8285-6-7.

Mel Sales Ltd. has located its head office at 1969 Avenue Road, Toronto 12. Telephone HU 1-0231.

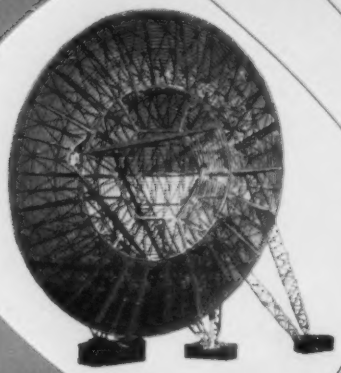
Process-Instrument Systems Ltd. has moved its Toronto office to 44 Haas Road, Rexdale P.O., Ont. New telephone is CH 1-4401.

Delta Electronics Ltd. has a 10,000-sq.-ft. plant under construction on the Queen Elizabeth Way at Clarkson, Ont., for the production of electronic amplifiers, parts and equipment. Moving day is September 15.

J. B. Morrison Machinery Co. Ltd. has moved its offices to 150 Bentworth Ave., Toronto 19. Telephone RU 7-0275-6-7.

SERVING YOU BEST...

in communications



In the North a line of steel guardsmen stand on sentry duty with eyes sweeping the horizon, ears listening to the silence of the snows . . . by his television set a farmer is studying the weather report . . . at your office the switchboard is receiving the first calls of the day. This is **communications,** where Northern Electric's research and development are pioneering new techniques and improving established ones.

The equipment for Canada's Trans-Continental Microwave system was manufactured and installed by the Northern Electric Company Limited, for the Trans-Canada Telephone System.

Northern Electric

SERVES YOU BEST

6659-1

Factory Burn-in. All high-reliability G-E 5-Star tubes receive a special burn-in at C.G.E. This method weeds out possible early failures and promotes uniform tube performance. Every G-E 5-Star Tube has also passed rigid mechanical and electrical tests before shipment.

GET EXTRA PROTECTION FOR CRITICAL TUBE APPLICATIONS WITH G-E 5-STAR TUBES

As a manufacturer of communication, radar, computer or other industrial and military electronic equipment, your products must continue to operate dependably under abnormal and severe conditions. You can expect this service when your designs specify G-E 5-Star Tubes.

G-E 5-Star tubes are made in Canada. Their ultra-reliability and longer life is a result of these special design features, controlled manufacturing processes, and rigid tests:

- Welded heater bar and baseleads for structural rigidity
- Double mica spacers resist shock and vibration
- Critical grids are gold or silver plated to minimize grid emission
- Extra severe tests for shock, vibration, heater cycling and long life
- Burn-in process stabilizes characteristics—weeds out possible early failures.

The chart on the right shows you the prototypes which should be replaced by G-E 5-Star tubes in critical sockets. They help assure your radar, communication, computer, or other critical electronic equipment will continue to perform reliably—building a solid reputation that will lead to repeat orders for your equipment.

For further information on Canadian-made G-E 5-Star tubes contact: Electronic Tube Section, Canadian General Electric Co. Ltd., 189 Dufferin Street, Toronto, Ontario.

QUICK REFERENCE FIVE-STAR REPLACEMENT CHART

Regular Receiving Tube Type	Replace with G-E Five-Star or other Specified Types	Regular Receiving Tube Type	Replace with G-E Five-Star or other Specified Types
2CS1	5670*, 5670A, 5670WA	6AC7	6134, 6AC7WA
2D21	5727, 2D21W	6SK7	6137, 6SK7WA
5Y3GT	6087, 5Y3WGTB		
6AK5	5654, 5654/6AK5W, 5654/6AK5W/6096	6BE6	5750, 6BE6W
		6BH6	6265*
6AL5	5726, 6AL5W, 6097	6C4	6100, 6C4WA
6AQ5	6005, 6AQ5W, 6095	6X4	6202, 6X4WA
6AS6	5725, 6AS6W	12AT7	6201, 12AT7WA, 12AT7WB
		12AU7	5814A*
6BA6	5749, 6BA6W	12AX7	5751*, 5751WA
6AS7G	6080	12AY7	6072*

*Heater current approx. 17% higher. Check heater circuitry before substituting.

GENERAL ELECTRIC
INDUSTRIAL AND MILITARY TUBES

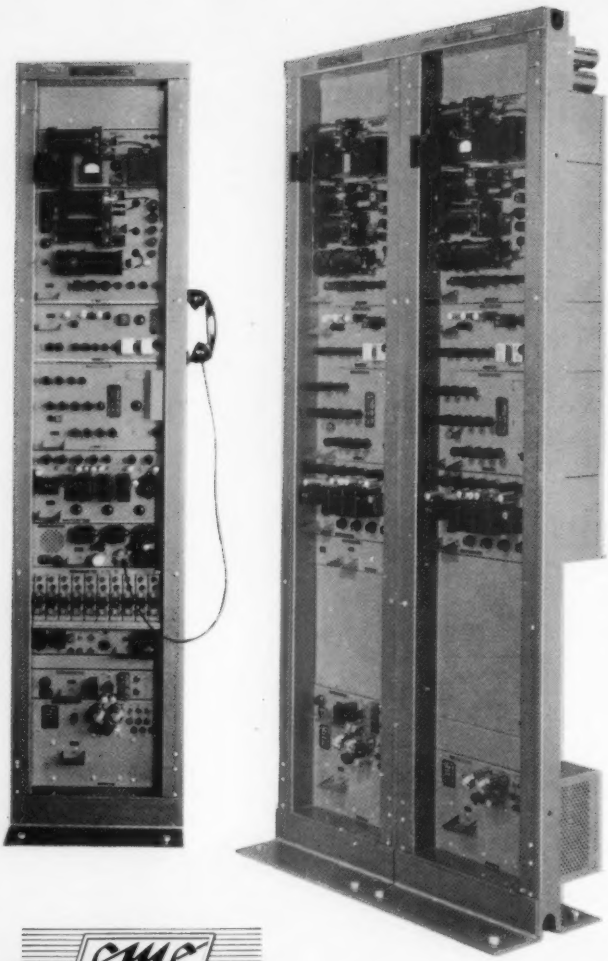
ELECTRONIC TUBE SECTION

1643-159

CANADIAN GENERAL ELECTRIC COMPANY LIMITED

CANADIAN MARCONI'S NEW DQ48B

MEDIUM HAUL RADIO RELAY EQUIPMENT



BRIEF SPECIFICATIONS OF DQ48B

TUNING RANGE:
750 to 1,000 Mc/s; 1,700 to 2,000 Mc/s.

MODULATION:
Phase modulation with de-emphasis. 0.35 radians rms for channel test level at frequencies above 100 kc/s

OUTPUT POWER:
5 watts (20 watts with Booster unit)

RECEIVER NOISE FACTOR:
Better than 12 db

FREQUENCY STABILITY:
± 0.005%

BASEBAND FREQUENCY:
Order Wire 0.4 to 2.4 kc/s ± 1 db; 0.3 to 2.8 kc/s ± 3 db

RESPONSE:
Fault Alarm 4 to 8 kc/s ± 1 db; 4 to 11 kc/s ± 2 db
Traffic 12 to 552 kc/s ± 1 db; 60 to 300 kc/s ± 0.5 db

LEVELS:

	(Tone at channel test level) Terminal	Repeater
SEND		
Order Wire	—36 dbm	—20 dbm
Fault Alarm (per tone)	—36 dbm	—30 dbm
TRAFFIC:		
Minimum	—40 dbm	—34 dbm
Maximum	—30 dbm	—24 dbm
RECEIVE		
Order Wire	—10 dbm	—16 dbm
Fault Alarm (per tone)	—13 dbm	—16 dbm
TRAFFIC:		
Maximum	— 6 dbm	— 9 dbm
Minimum	—16 dbm	—19 dbm

IMPEDANCES:
RF: 50 ohms unbalanced
IF: 75 ohms unbalanced
Traffic: 75 ohms unbalanced
FA and EOW: 600 ohms unbalanced

INTERMEDIATE FREQUENCY:
70 Mc/s

POWER SUPPLIES:
100-125 V or 200-250 V ± 5%. 60 c/s ± 5 c/s
Approximately 400 VA per rack. (with Booster unit, approximately 500 VA). (Other alternative power units available on request.)

CMC CANADIAN MARCONI COMPANY

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CANADIAN MARCONI COMPANY

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Multichannel Radio Relay Telecommunications, Fault Alarm Supervisory Systems and Special Test Equipment.

You are invited to inspect this equipment and demonstration links at any time.

For further information mark No. 26 on our Readers' Service Card

CANADIAN MARCONI'S NEW DQ58

ADOPTED FOR CANADA'S AIR DEFENCE SYSTEM

BRIEF SPECIFICATIONS OF DQ58

TUNING RANGE:
1700—2300 Mc/s

MODULATION:
F.H.

TRANSMITTER OUTPUT POWER:
10 watts minimum

RECEIVER NOISE FACTOR:
Better than 13db

BASEBAND TERMINAL TO TERMINAL:

Order wire	.3 to 3.5 kc/s+1db
Fault alarm	4 to 10 kc/s±0.5db
Traffic	12 to 1052 kc/s±2db
	60 to 1052 kc/s±1db
	60 to 2540 kc/s±2db

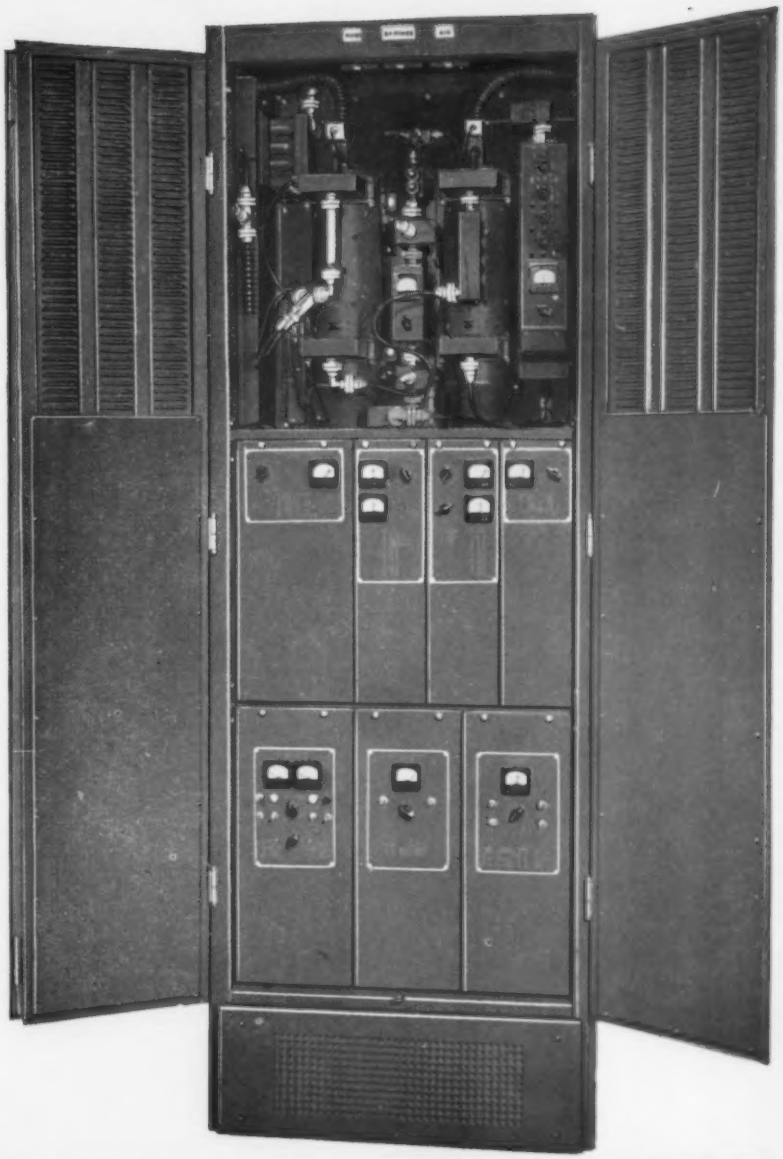
BASEBAND REPEATER TO REPEATER OR TERMINAL:
Drop and insert facilities
12 to 108 kc/s±1db

IMPEDANCES:
Traffic 75 ohms unbalanced
F.A. and EOW—600 ohms unbal.
R.F. 50 ohms unbalanced

POWER SUPPLIES:
100 — 125V
200 — 250V
55 to 65 c/s

CABINET SIZE:

Width	32"
Depth	18"
Height	93¼"
Total weight	615 lbs.



CANADIAN MARCONI COMPANY,

RADIO RELAY DEPARTMENT,

970 McEACHRAN AVENUE, MONTREAL 8, CANADA, TEL: CR. 6-3627

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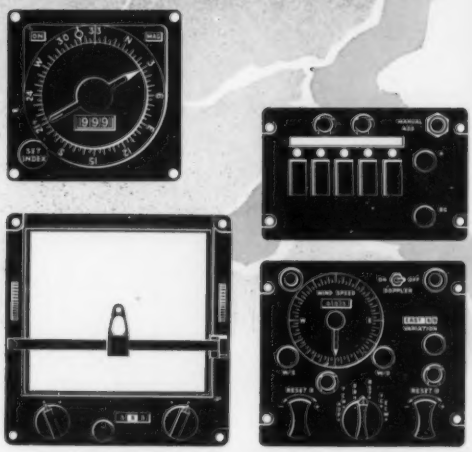
ANADAC

Automatic Navigation Display and Computer

A NEW CONCEPT IN NAVIGATION

ANADAC is a versatile instrument system for navigational computation and display in which dead reckoning facilities are fully integrated with other sources of navigation intelligence in a compact system for even the smallest combat aircraft. It is a logical sequel to CARL's experience with other navigation equipment such as the R-Theta which has been in operational use for several years.



A panel display to suit most operations can be selected from the following units · Pilot's Navigation Indicator · Control Panel (including Function Selector) · Station Selector · Pictorial Display Unit · It can be used in conjunction with Doppler and Data Link. The Pilot's Indicator can display track, bearing, or range and bearing information as applicable from any of these sources: DEAD RECKONING COMPUTER, TACAN or VOR/DMET, COMPASS, ADF.

CANADIAN APPLIED RESEARCH LIMITED

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CANADIAN APPLIED RESEARCH LIMITED CARL

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ELECTRONICS • MECHANICS • OPTICS
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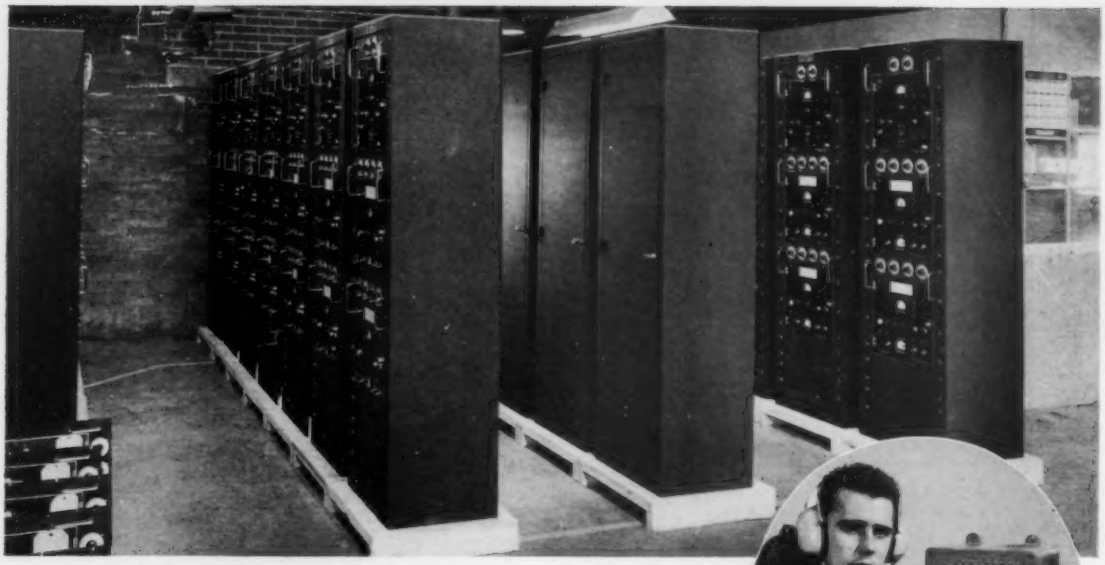
Available:

Twelve years experience in military electronics— yours at low cost



A few of the many VHF Marker Beacon Transmitters designed and built by Measurement Engineering to Canadian government specifications.

MILITARY EQUIPMENT, no matter how large or small the order, is built to the highest standards at surprisingly low cost by Measurement Engineering Limited. We are able to offer our design, development and precision manufacturing facilities at a reasonable price because of our near-Ottawa location in a stable, low-cost labor area. Our personnel are security cleared and familiar, through experience, with military specifications. All production, including sheet metal fabrication, is carried out under one roof.

Headset and selector station for naval sound-powered telephone systems, designed and built by MEL for Canadian Navy.

Ask for our illustrated facilities brochure

During the past twelve years we have built the following types of equipment:

Communications Transmitters and Receivers
Audio Systems
Nuclear Instruments
Test Equipment
Electro-Mechanical Assemblies

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HEAD OFFICE AND PLANT: ARNPRIOR, ONTARIO

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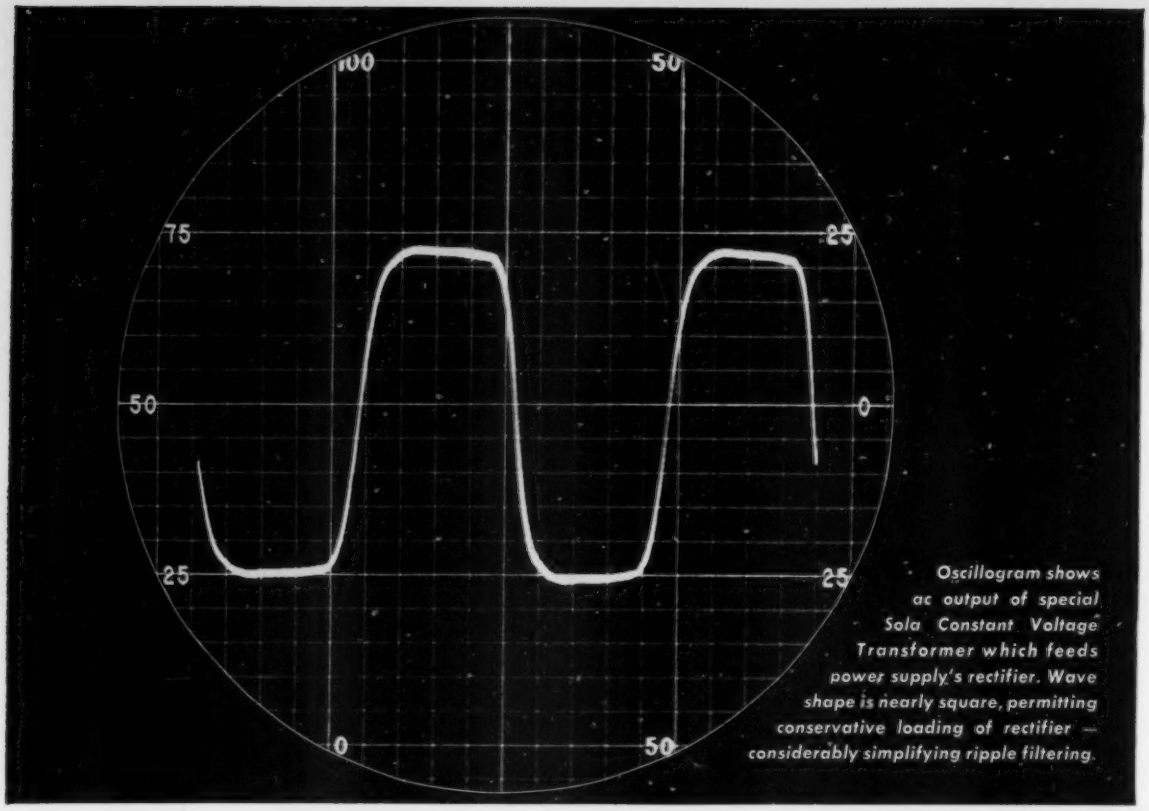
For further information mark No. 39 on our Readers' Service Card



Oscillogram shows ac output of special Sola Constant Voltage Transformer which feeds power supply's rectifier. Wave shape is nearly square, permitting conservative loading of rectifier — considerably simplifying ripple filtering.

Square-wave output of special transformer gives high efficiency in Sola's regulated dc power supply

Sola engineers (men with a keen eye for a trim wave shape) designed a special constant voltage transformer having nearly a square-wave output. Then they linked the transformer with two other components to produce a regulated dc power supply which has notable efficiency.

They fed the regulated output of this transformer into a semiconductor rectifier . . . the low-peak characteristic of the square wave results in a conservative loading on the economical rectifier assembly. It can deliver considerable amounts of current as long as you don't overvoltage it—and over-voltaging just doesn't happen when the input to the rectifier is Sola-regulated to within ±1%.

The rectified voltage feeds into the third component in this happy combination—the high-capacitance filter. The capacitor's filtering job is made easier because the rectified square wave contains a comparatively small amount of ripple. Final dc output from the filter has less than 1% rms ripple . . . for many applications there is no need for a voltage-dropping, efficiency-cutting choke coil.

The Sola Constant Voltage DC Power Supply has output in the ampere range, regulates within ±1% even under ±10% line voltage variations, and is suitable for intermittent, variable, and pulse loads. It has low output impedance, is very compact, and provides about all you could ask for in maintenance-free dependability.

Hundreds of ratings of these dc power supplies have been designed and produced to meet widely varying electrical and mechanical requirements of equipment manufacturers. In addition, there are six stock variable-output models and six stock fixed-output models with ratings from 24 volts at six amps to 250 volts at one amp.

For complete data write for Bulletin 52H-DC

SOLA ELECTRIC (CANADA) LTD., 24 Canmotor Avenue • Toronto 18, Ontario • Phone: CLifford 1-1147
In The United States, Sola Electric Co., Chicago 50, Illinois, A Division of Basic Products Corporation

SOLA

CONSTANT VOLTAGE TRANSFORMERS

REGULATED DC POWER SUPPLIES

MERCURY LAMP TRANSFORMERS

FLUORESCENT LAMP BALLASTS

For further information mark No. 57 on our Readers' Service Card

PROBLEM: Make conductors that stay "alive" at Mach 30

Equipment is so closely packed within missiles and supersonic aircraft that wires and electronic gear scarcely have a chance to dissipate their own intense heat . . . compounded by the sizzling heat built up as the crafts' thin shells knife through the air.

Developing high temperature insulations for these applications—for countless other applications where miniaturization of equipment has created hotter running conditions—is a major project at Canada Wire. An example of the dramatic breaks being made in heat barriers is the development of TEFLON*, an insulation capable of continuous service at temperatures as high as 250°C.

At all times, over fifty new materials are actively being investigated at the Canada Wire research centre. It is insurance that your future needs will be met without costly delay . . . that all Canada Wire and Cable Company Limited products are always the highest possible quality at the lowest possible cost.

*TEFLON is a Du Pont trademark

TRADE MARK REG'D.

QUALITY CABLE IS LOW-COST CABLE!

Canada Wire and Cable Company Limited

A Canadian Company Manufacturing and Selling Coast to Coast

Canada Wire *magnet wire*

54 kinds of insulation to meet the most exacting requirements

this newest form of packaging . . . plus . . . complete range of spool sizes

Pick the kind of packaging that's best for you

The facilities of Canada's most modern magnet wire plant now make it possible for Canada Wire to supply your requirements in this newest and most convenient form of packaging, *in addition* to a complete range of spool sizes. "Pail-Paks" and "Barrel-Paks," the latter in both full and half sizes offer great advantages. Fully protect wire against dust and damage. Greatly reduce volume of handling in your plant. Eliminate much of the time now wasted in changing spools.

INSIDE—BETTER MAGNET WIRE THAN EVER

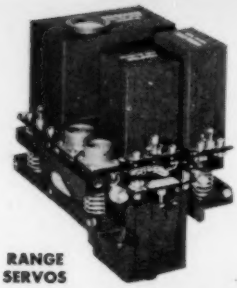
Made at a plant engineered from the ground up to produce the finest and most uniform quality magnet wires modern technology can create. The *only* magnet wire plant in Canada with facilities for storing 30,000 gallons of wire coating enamels, eliminating the variations formerly found from batch to batch in using drum-type shipments. Completely air conditioned to remove all dust that might contaminate enamel insulation. Automatic production that assures minimum handling.

WIDEST RANGE — Choice of 54 kinds of insulation to meet the most exacting operating requirements. Thicknesses from No. 9 to No. 50. NOTE —contact your nearest Canada Wire sales office for details of sizes available in Barrel-Paks and Pail-Paks.

Canada Wire and Cable Company Limited

Magnet Wire Division — Simcoe, Ontario

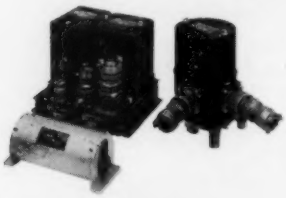
A *Canadian* company manufacturing and selling coast to coast



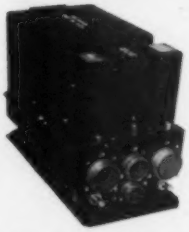
RANGE SERVOS

MISSILE LAUNCHING COMPUTERS

TRANSDUCERS

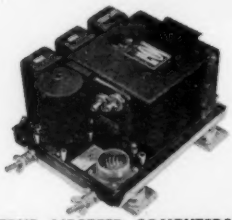


THRUST CONTROLLERS



WIND DRIFT COMPUTERS

VERTICAL SCALE INDICATORS



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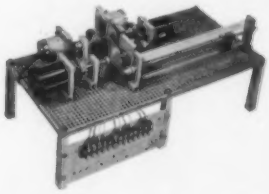
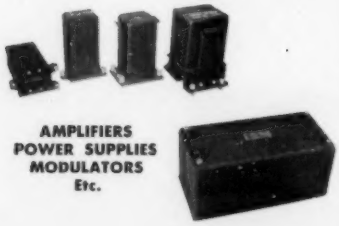
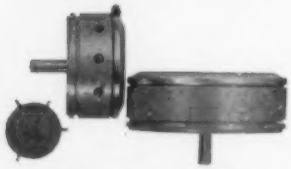
CONTROL DEVICES FOR INDUSTRIAL AND SCIENTIFIC APPLICATION



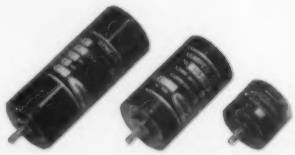
BREADBOARDING KITS AND COMPONENTS



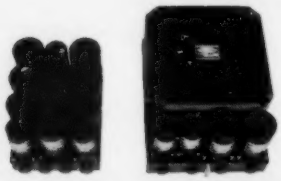
AMPLIFIERS
POWER SUPPLIES
MODULATORS
Etc.



METAL FILM POTENTIOMETERS



MINIATURE INSTRUMENT MOTORS



CENTRAL AIR DATA COMPUTERS

PITOT STATIC and RELATIVE WIND BOOMS

BAROMETRIC ALTITUDE CONTROLLERS

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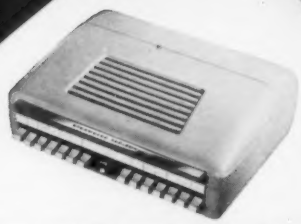
THE MOST COMPLETE RANGE OF COMMUNICATION SYSTEMS

Hackbusch Electronics Limited offer you a complete range of high quality Stromberg-Carlson communication and intercommunication systems. Each system represents the most outstanding development within its field—Pagemaster, Key-Municator, Dial-X and conventional sound systems. Complete equipment, replacement and parts facilities are maintained to provide the ultimate in coast to coast service.

PAGEMASTER provides direct, instantaneous, personal paging for key personnel within plants, hospitals, large offices, hotels and many others. Receivers have D.O.T. approval P1.



KEY-MUNICATOR a new concept in intercommunication—compact, has audio and visual signaling, can be expanded in multiples of 14 stations.

CONVENTIONAL SOUND amplifiers, speakers, microphones and record playing equipment. Also completely engineered systems for public address, paging, music distribution systems in schools, hospitals and music therapy systems.

DIAL-X solves communication problems by giving two systems, two phones —one for 100% service and one for 100% outside service. Dial-X reduces telephone costs.

A trained technical representative will gladly furnish further details.

There is nothing finer than a Stromberg-Carlson.

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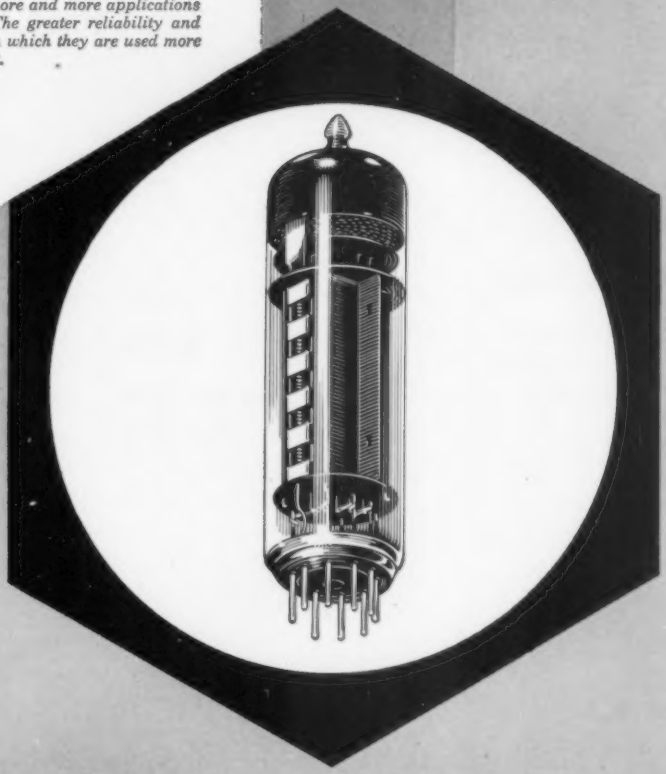
The Rogers 6360 twin tetrode. is a Special Quality* miniature transmitting tube designed to give reliable, efficient and long life performance at V.H.F. up to 225 Mc/s at maximum ratings.

Typical plate output power is 14.0 watts at 200 Mc/s with a plate supply voltage of only 300 volts. As a tripler with an output of 175 Mc/s, 5.5 watts is obtained with a plate supply voltage of 300 volts.

The 6360 is particularly suitable for push-pull operation in either fixed or mobile transmitters and may also be used as an amplifier, oscillator, multiplier, modulator or audio amplifier. In new equipment or for replacement purposes, this Special Quality tube provides high output at very low initial cost.

**Rogers Special Quality tubes are finding more and more applications in all types of professional equipment. The greater reliability and lower maintenance cost of the apparatus in which they are used more than compensates for the higher initial cost.*



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electronic tubes & components

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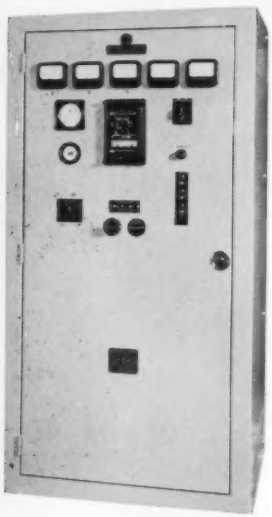
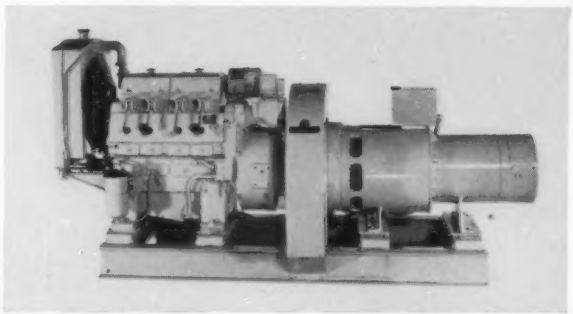
★ Rogers Electronic Tubes are sold through Canada's Independent Electronic Parts Distributors

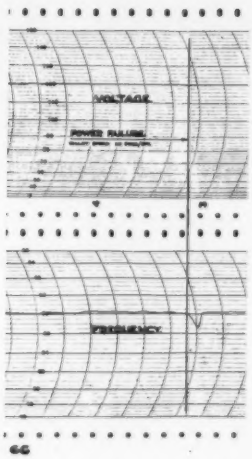
precise electric power to customer specifications

Mechron automatic no break and primary power diesel generating equipment

Installation and Field Maintenance Service Available







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Are Used by the

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and other

GOVERNMENTAL DEPARTMENTS

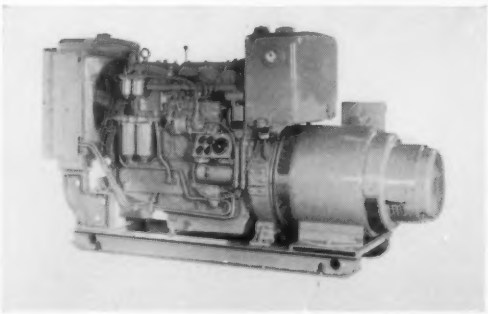
Major Communications Companies also rely on

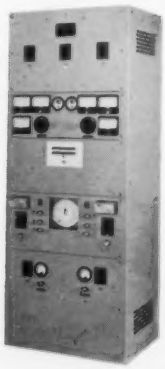
MECHRON DIESEL GENERATORS FOR RELIABLE POWER

Designed and produced in Canada by

MECHRON NO BREAK DIESEL GENERATORS

maintains the voltage constant with negligible frequency droop when primary power fails





MECHRON ENGINEERING PRODUCTS LIMITED

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are facilities and experience meeting the needs for contract or sub-contract work in the defense programs of Canada and the United States

Standard Telephones & Cables are currently engaged in major phases of telecommunications and radio aids to navigation.

The resources that STC offer are: complete facilities for fabrication with in-plant finishing and painting . . . quality-controlled production of sub-assemblies, assemblies and entire equipments . . . environmental testing and resident Government inspectors . . . expert installation and service teams . . .

Standard Telephones & Cables, a name long-established in telecommunications, has broad MIL-approved facilities for electronic and electrical production. STC is an associate of the International Telephone and Telegraph Corporation, and is now participating in both the Canadian and United States defense programs.

Standard Telephones and Cables Mfg. Co. (Canada) Ltd.

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AN ASSOCIATE OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

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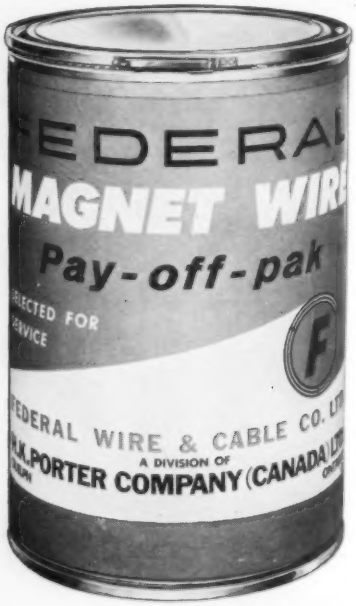
FEDERAL "Pay-Off-Paks"

pay off in *speed* and *profits*

This cost-reducing method of magnet wire packaging and handling, pioneered by Federal Wire in 1956, has been paying off in speed and extra profits on every installation. Simply open the container and thread. The wire pays off like a fisherman's line from a spinning reel. There are no backlash, overrun or inertia problems and most important—no stopping to solder during winding.



- One "Pay-Off-Pak" holds approximately 500 lbs. of size 12-23 magnet wire—replaces 10 reels—reduces soldering and downtime.
- "Pay-Off-Paks" eliminate need for a wide range of reel sizes.
- Reduced investment in returnable reels.
- Set-up time on the winding machines is cut to a minimum.
- Interlocking tops and bottoms allow storage in a minimum amount of space.
- Made of tough, reinforced fibre—standard-size container weighs only 22 lbs.
- Also sizes 24-29 available in 100 lb. "Pay-Off-Pak" and sizes 12-23 AWG in 250 lb. "Pay-Off-Pak."

Speed up production with a Federal "Pay-Off-Pak". You can depend on the quality of Federal Magnet Wire.

5900

FEDERAL WIRE PORTER ***& CABLE DIVISION***

H.K. PORTER COMPANY (CANADA) LTD.

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; Copper and Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION, H. K. PORTER COMPANY de MEXICO, S.A., and in Canada, Refractories, "Disston Tools," "Federal" Wire and Cable, "Nepcoduct" systems H. K. PORTER COMPANY (CANADA) LTD.

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Over 30 major radio relay systems use

RCA VICTOR MICROWAVE

for dependable communications

•—•—• *Dotted lines show Microwave systems employing Microwave equipment manufactured in Canada by RCA Victor.*

Another indication of the wide electronics experience that RCA Victor in Canada offers you.

About 75% of the present Canadian market for Microwave equipment is supplied by RCA Victor. This is solid proof of the leadership of RCA Victor's Technical Products Division, whose work includes such communications areas as Radar, Microwave, defence and commercial electronic systems.

But Technical Products is only one of the experienced, capable divisions at your service for defence contract work.

The *Electron Tube and Semi-Conductor Division* offers specialized services in the miniature tube field and in semi-conductor and all defence-type tube development and manufacture.

Engineers and technicians of the *Technical Products Service Division* will install, service and maintain RCA Victor electronic equipment both in-plant and in the field.

RCA Victor's *Research Laboratories* in Montreal have done distinguished, original work in solid state physics, photo-conductivity, radar system studies, wave propagation and many other areas.

For information on how RCA Victor can help solve your electronic problems, contact the General Manager, Technical Products Division, RCA Victor Company, Ltd., Montreal.

For 60 years, serving Canadian homes, industry and defence

RCA VICTOR COMPANY, LTD.

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UP WHERE DEFENSE BEGINS...

The vastness of Canada's far north is today one of the fields of operations for the technical representatives of the Philco Government and Industrial Department.

Here, Philco representatives work to maintain the radar lines and communications system essential to North American defense.

The production of airborne radar for anti-submarine defense is just *one* example of Philco leadership in creative engineering, production and maintenance of electronic equipment for *all* requirements.

Yes, Philco places equal importance on the continuous *maintenance* of Canada's early warning defense systems. Twenty-four hours a day, Philco engineers place their specialized knowledge at the service of their country.

The same skill and dedication is available to *you* . . . whatever your needs in electronic equipment.

Get the complete story. Write . . .

PHILCO

government and industrial dept.

PHILCO CORPORATION OF CANADA LIMITED,
DON MILLS, ONTARIO

For ALNICO MAGNETS—Stock or Special

Specify "ARNOLD"

Materials

Cast Alnico Magnets are most commonly made in Alnico V, VI or III. Sintered Alnico Magnets usually are made in Alnico II, V or VI. Special permanent magnet materials supplied by Arnold include Vicalloy, Arnox III and V, and Cunife.

Engineering Data

Write for your copy of *Bulletin GC-106C*, a general catalog of all Arnold products. It contains useful data on the physical and magnetic properties of Alnico magnets. Lists stock items and standard tolerances for cast and sintered magnets—also stock sizes and pertinent data on tape cores, powder cores, C & E cut cores, etc.

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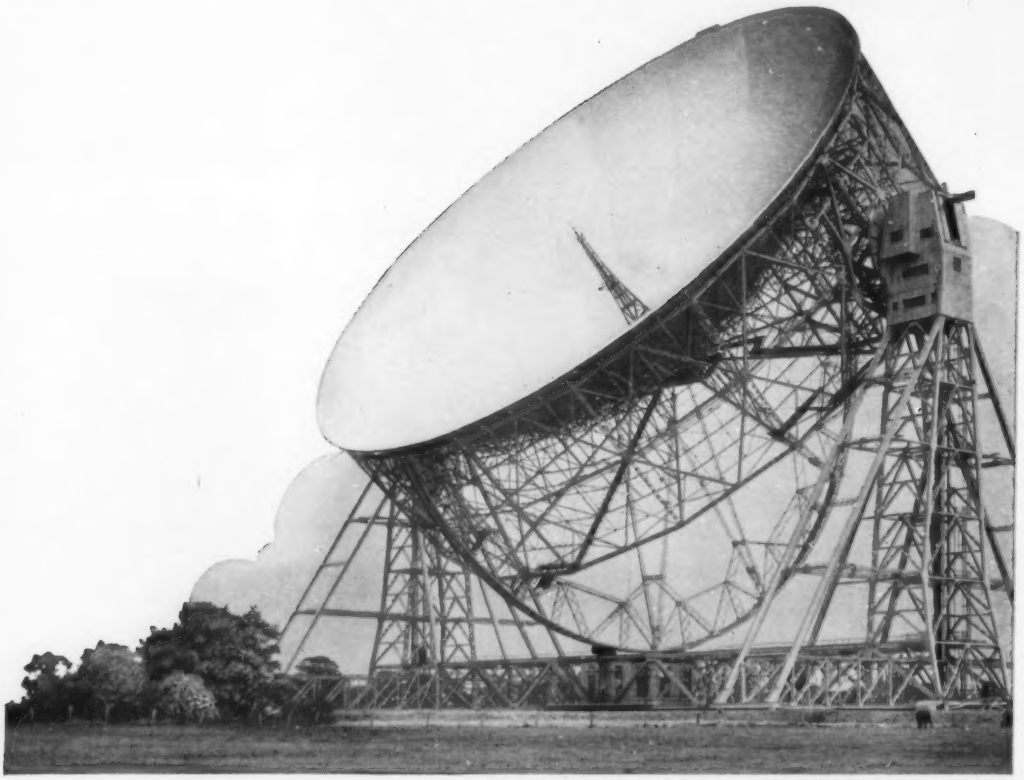

Photograph by courtesy of the Director of the Jodrell Bank Experimental Station

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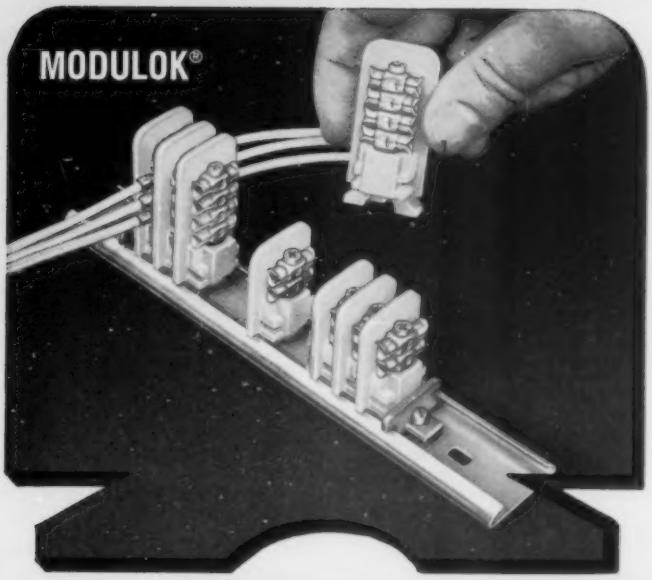

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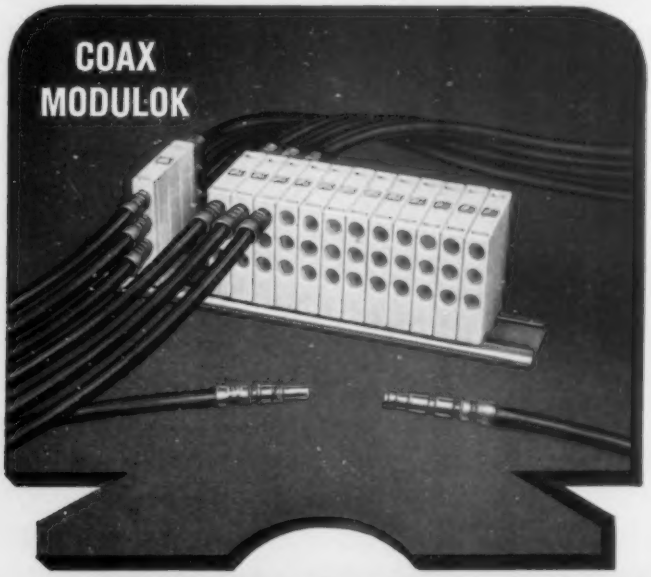

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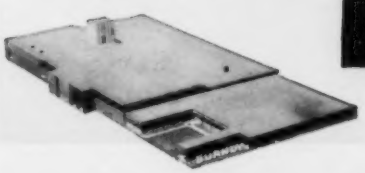

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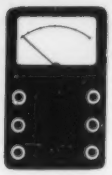

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MODEL 373
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MODEL 374
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MODEL 375
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MODEL 376
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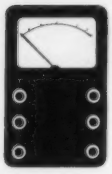

MODEL 378
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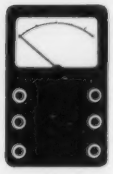

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MODEL 377
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372	0-500 ohms to 0-50 Meg ohms in 6 ranges
373	1/5/10/25/50/100/250/1000 D.C. Milliamperes
374	50/100/250/500/1000 D.C. Microamperes
375	1/2.5/5/10/25 D.C. Amperes
376	5/10/25/50/100/250/500/1000 A.C. Volts at 1000 ohms per volt
377	1/2.5/5/10/25/50/100/250/500/1000 D.C. Volts at 1000 ohms per volt
378	5/25/100/250/1000 A.C. Milliamperes
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SOLUTION: ANDREW engineers specified, designed, and produced a rectangular array of 32 aluminum corner reflectors that met all electrical and mechanical requirements of this system for telemetry, control, and voice communication.

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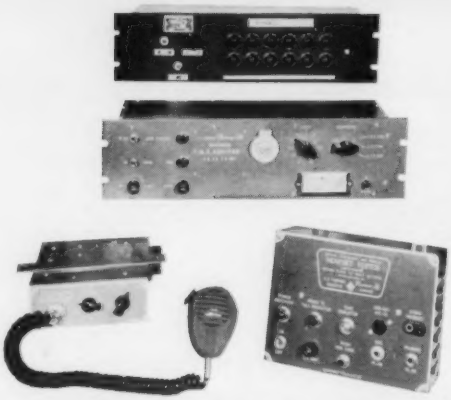

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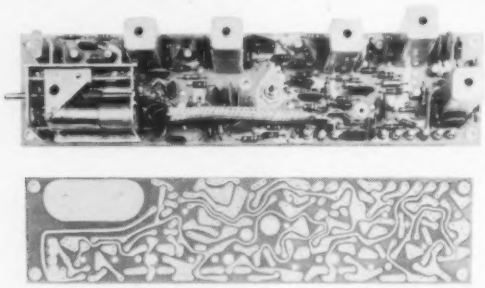

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- Transistorized, high performance
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- Frequency Range—50 to 220 Kc/s, 0.1 to 2.0 watts
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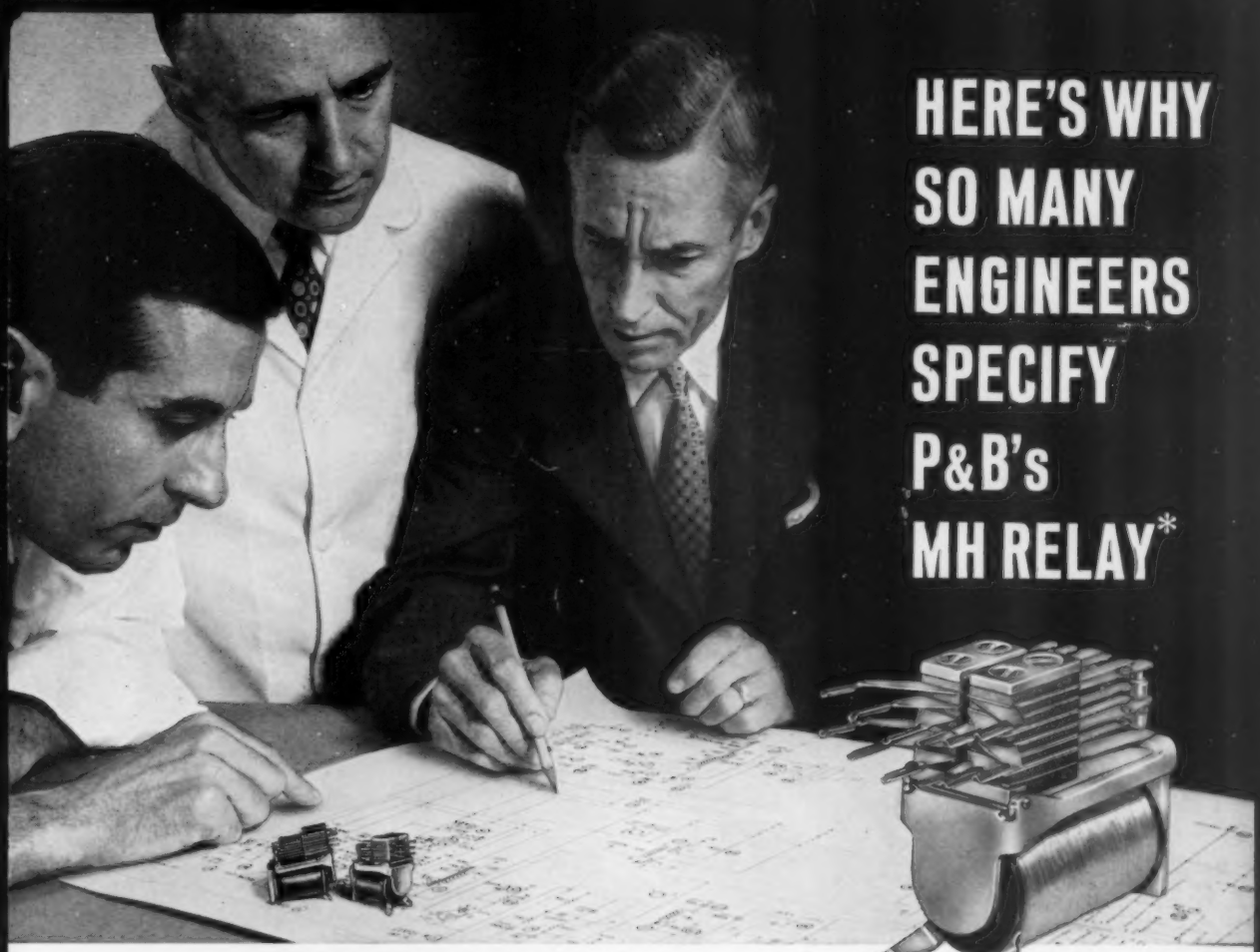


HERE'S WHY SO MANY ENGINEERS SPECIFY P&B's MH RELAY*

*AND VARIATIONS OF THIS BASIC STRUCTURE SHOWN BELOW

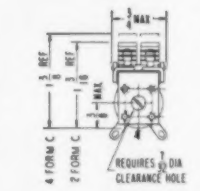
Shown with printed circuit terminals

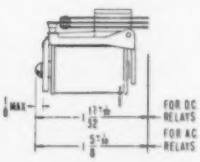
VERSATILITY

and adaptability are prime reasons why designers have made the MH a P&B best seller. This relay series, for example, does yeoman duty in such diverse applications as jet aircraft, street lighting equipment, computers and missile ground controls.

When multiple switching is required... when size, weight, long life and reliability are critical ...our MH relay can usually fill the bill. It's RIGHT for countless jobs, often at countable savings.

Let us send you complete information about this miniature telephone-type relay and the variations we've evolved for special applications. Write or call today.





ENGINEERING DATA/MH RELAY

Insulation: Laminated phenolic.

Insulation Resistance: 100 megohms minimum.

Breakdown Voltage: 500 volts RMS between all elements.

Shock: Up to 30g.

Vibration: Up to 10g from 55 to 500 cps.; .065" max. excursions from 10 to 55 cps.

Ambient Temperature: −45°C. to +85°C. −(65°C. to +125°C. on special order).

Weight: 2½ oz. max. (open relay)

Pull-In: Approx. 75% of nominal voltage.

Pull-In Speed: Approx. 15 ms.

Drop-Out Speed: Approx. 10 ms.

Terminals: Pierced solder lugs; special lugs for printed circuits, taper tab (AMP #78).

CONTACTS:

Arrangements: Up to 9 springs per stack.

Material: ⅛" silver; also Palladium or gold alloy.

Load: Dry circuits to 5 amps @115V AC resistive.

COILS:

Resistance: 22,000 ohms max.

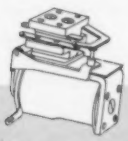
Power: 100 milliwatts per movable minimum to 4 watts at 25°C. max. (200 mw. min. to meet max. shock/vibration spec.)

Duty: DC: Continuous. AC: Intermittent (2 pole relay max.)

Voltages: DC: Up to 110 volts. AC: Up to 230 v. 60 cycles.

Current: 2.5 ma to 10 amps DC.

P&B STANDARD RELAYS AVAILABLE AT YOUR LOCAL ELECTRONIC PARTS DISTRIBUTOR



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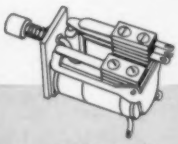
For RF switching where intercontact capacitance losses must be minimized. Ceramic contact spacers.



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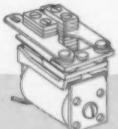
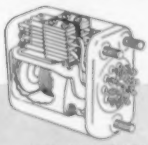


MB CONTACTOR

Contacts rated 60 amp. 28 volts DC non-inductive. Will carry 150 amp. surge for a duration of 0.3 seconds.



MH SEAL-TEMP

Features sealed coil to minimize contact contamination. Available as hermetically sealed relay only.

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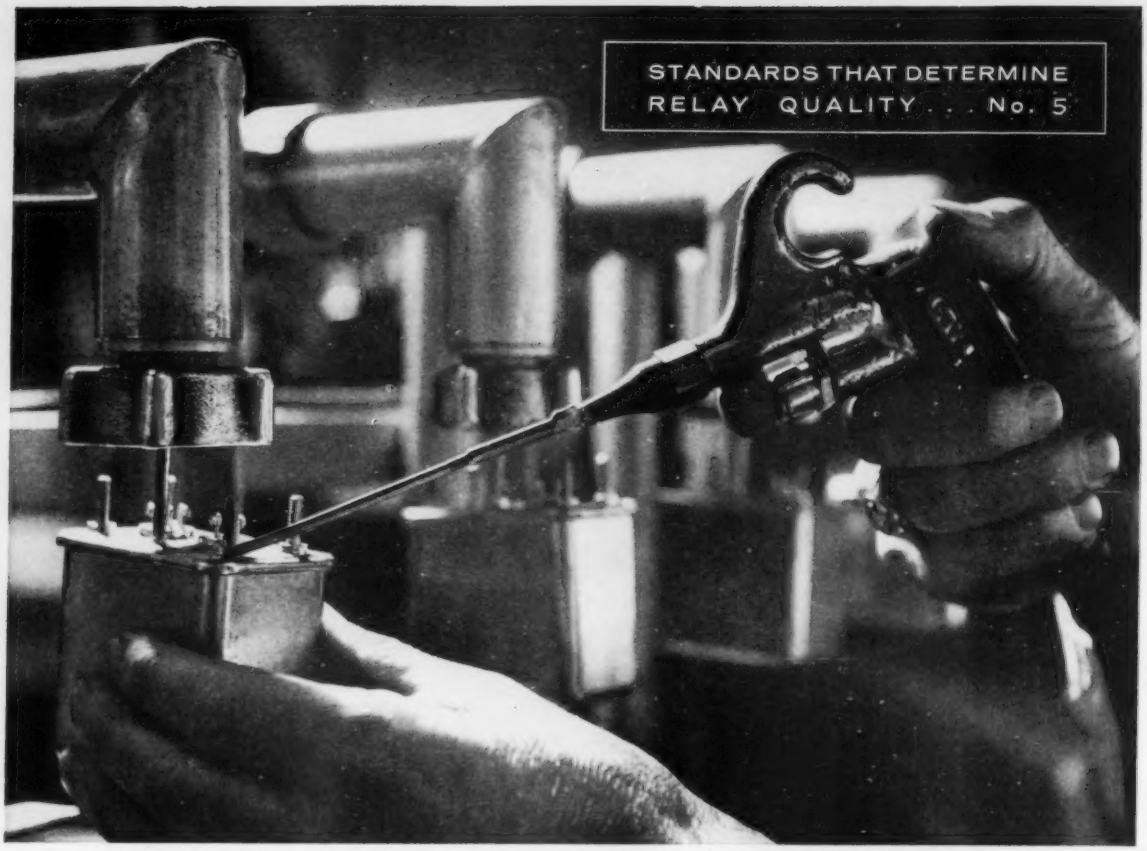

Tracer gas is sprayed over the relay enclosure while it is under high vacuum.

100% leak-free hermetic sealing

We reject relays with leaks so tiny that it would take 30 years to admit 1 cubic centimeter of air!

Hermetically sealed relays are safe from the dangers of human tampering, and from severe conditions of dust and dirt, sand, moisture and high humidity, fungi, salt spray and reduced air pressure. To insure this safety, however, sealed relays must be absolutely free from leaks.

That is why, at Automatic Electric, every single hermetically sealed relay undergoes a *sensitive mass spectrometer test.* This highly refined method of testing detects leaks so tiny that it would take *more than 30 years for one cubic centimeter of air to pass through!* To protect you, we reject "leakers" able to pass ordinary immersion tests with ease.

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Hermetically sealed relays are available in many varieties. *Write today for full information. Address: Automatic Electric Sales (Canada) Ltd., 185 Bartley Drive, Toronto 16, Ontario. Branches across Canada.* 5948

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Why not integrate responsibility, too?

The Canadian electronics industry is, we are sure, well pleased with the efforts that have been made to establish a working Production Sharing Program for joint North American defense. But there are some who seriously doubt whether it will be a complete success.

The principles of such a program have been agreed by the political leaders of the United States and Canada. Prime Minister Diefenbaker expresses his government's hopes on page 1. And the Defence Production Minister's recent announcement of financial assistance for tooling, and component and other development costs provides a solid incentive for industry.

At the administrative level, the staffs of the Departments of Defence Production and National Defence are doing everything they can in co-operation with their U. S. counterparts. DDP Deputy Minister Golden tells of their progress on pages 36 and 37.

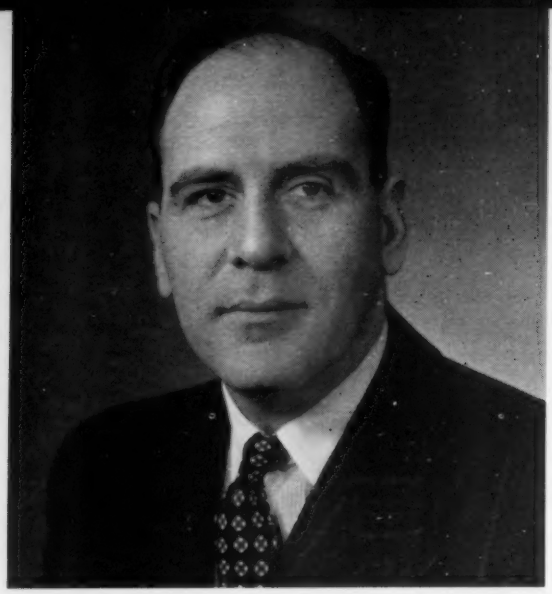
Canadian industry itself must recognize that it is in direct competition with American firms, and back these efforts on its behalf by an aggressive sales campaign and adequate demonstration of its competence. EIA President Brownlee makes this point on page 37.

One of the keys to success will be found in the extent to which the operating-level procurement officers of the U. S. Armed Services and their prime contractors are familiar with the capabilities of Canadian industry. Canadian Electronics Engineering therefore presents the survey of electronics companies on pages 43 to 59. We hope that this will be of direct use to the U. S. agencies and companies who have received a special mailing of this issue.

All these contributions, however, do not assure continued success for the program now being established. Dependence on voluntary production sharing arrangements from American companies could lead to Canada making less than the proportional contribution it can afford, particularly if protectionist pressures arise from segments of U. S. industry.

Would it not be better for Canada, and a surer guarantee of a solid future for our defense industry, if we were also to take complete responsibility for development and production of some specific aspects of North American defense? There are several areas in which Canadian industry has the necessary facilities, and scientific and engineering abilities. In these fields we could complement, not duplicate, efforts going on in the United States and the United Kingdom.

THE EDITOR



Production sharing and defence electronics

D. A. GOLDEN, Deputy Minister,
Department of Defence Production, Ottawa.

The principal idea underlying production sharing — that Canada and the United States should pool their economic resources for defence — is at least as old as World War II. But the actual production sharing programme, like the term itself, is a relatively new element in the relations between the two countries. Its immediate cause lay in the major defence policy decisions of the past year. These decisions made it abundantly clear that, because of the increasing complexity of modern weapons systems and the growing integration of Canadian and United States measures for continental defence, it would be extremely difficult for this country to undertake alone the development and production of its major weapons.

It had, in fact, been evident to the Department of Defence Production for some time that such programmes as the Bomarc missile, Sage and the strengthening of the Pinetree Line, as well as the possibility of other more remote programmes for defence against ballistic missiles, would require the re-orientation, in a large measure, of defence development and production in Canada. Instead of concerning ourselves primarily with the needs of the Canadian Forces alone, it would be increasingly necessary to work out co-operative arrangements with the United States. In theory, such co-operation was provided for in the Hyde Park Agreement of 1941 and the Statement of Principles for Economic Co-operation of 1950. However, this general idea of co-operation had to be given practical expression in a manner appropriate to the new circumstances. The result was the Production Sharing Programme.

U. S. responds promptly

As soon as this need was recognized, the United States authorities were approached. Their response was prompt and co-operative, and in a remarkably short space of time the programme was launched with an agreed set of objectives. The immediate goal was — and continues to be — to increase the participation of Canadian industry in the production and support of North American defence weapons. At the same time, the long-term nature of the problem was recognized, and it was agreed that this could only be met by co-ordinating the defence requirements, development and production of the two countries, throughout the years to come, in such a way as to make the best use of their respective production resources for their common defence.

The spirit of co-operation which made possible so promising a beginning for the programme has continued to characterize its development. As a result, we have obtained from the United States Government a framework of policy and regulations which is favorable to Canadian participation in their procurement programmes. This has meant major modifications in their regulations.

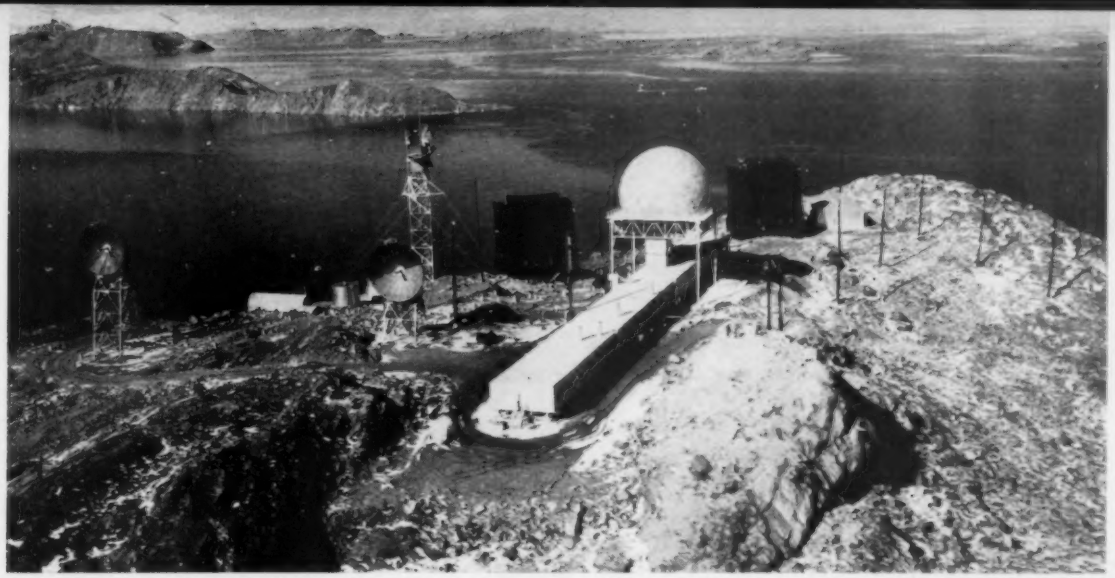
Buy American Act revised

The most striking example of action of this kind was the revision of the Buy American regulations. The general effect of this change was, of course, to waive the Buy American Act in respect of purchases in Canada of the main kinds of defence equipment within the capabilities of Canadian industry. In fact, Canadian defence suppliers now receive, from the United States Government, preferential treatment over all other foreign sources, and in many respects equality with domestic suppliers.

Other important impediments to Canadian industry have also been removed, largely or wholly, by the American Government. Canadian firms bidding for sub-contracts from United States prime contractors are finding it possible, in most cases, to obtain duty-free entry privileges. United States security restrictions, which are applied very strictly, can be overcome wherever it can be shown that Canadian firms have a legitimate interest, under the Production Sharing Programme, in Unted States defence projects. Canadian industry is therefore finding it easier to discuss with the U. S. Services and with their large defence contractors many of the important programmes in which they are engaged.

United States authorities have also recognized that their production sharing policy can only be made effective at the lower levels of their Armed Service Departments, often at procurement centres far removed from Washington and by contractors. They have therefore given their wholehearted support to an intensive programme aimed at making their procurement offices and contractors aware both of the implications of the new policies and regulations of their own Government, and the capabilities of Canadian industry. They have agreed that, even though a favourable framework of policy and regulations has been achieved, there can be no let up in their efforts, or ours, to make the new arrangements work in the intended manner.

For Canadian industry, the Production Sharing Programme means new opportunities, and a new challenge. Its implications for the electronics industry in particular were



This remote Dew Line installation illustrates the importance of electronics in North American Continental defence

well summarized by the Minister of Defence Production in Parliament on July 8: "The growing integration of our defence forces with those of the United States," he said, "probably has a greater effect on this industry than on any other since the electronic content is particularly high in those weapons which form the basis of that integration. We are therefore now in a transition period, which is likely to persist for two or three years, during which Canadian defence electronic production must be re-oriented, in a very large measure, to serve a North American rather than a Canadian market."

Competition is important

The new opportunities which this situation creates will be readily apparent when one considers the enormous size and diversity of the United States defence procurement programme. Obvious as they are, however, they may possibly be forgotten by Canadian industry in its preoccupation with the challenge which the Production Sharing Programme presents. The United States Government is no less insistent than the Canadian Government on the importance of competition as a basis for the award of defence contracts. Canadian firms cannot help but be conscious that, in seeking American defence orders, they are entering a highly competitive field. Price competition will, of course, be an important element in this. In many cases, however, the technical aspects of proposals may be of equal or even greater importance. Efficiency and cost consciousness in manufacturing operations are therefore not enough; there must also be an application of imagination and engineering skills of the highest order in the framing of proposals.

There must also be a concentration of effort on those things which Canadian industry can do best. To ride off in all directions, and try to compete across the board, would be fatal to Canadian hopes. Facilities and know-how must be carefully assessed, and brought to bear in those directions in which they can be most effective.

Everything that the Canadian Government has done and is continuing to do rests on the assumption that Canadian industry can meet this challenge and make the most of the new opportunities. The Government cannot place American orders in Canadian plants. It can — and it will — help Canadian industry to identify the new opportunities and to exploit them.

Efforts are being made to advise Canadian firms of what is involved in doing business with United States agencies and contractors. Both the Department of Defence Production and the Canadian Commercial Corporation are keeping abreast of United States requirements, in order to identify and to draw to the attention of Canadian firms any opportunities which are likely to be of interest. The Department has welcomed inquiries from interested Canadian firms, and its offers of advice and assistance remain open.

Above all, it is recognized that, as far as possible, the engineering capacity of Canadian industry must be maintained and its technological progress fostered if the future of production sharing is to be assured. The weapons systems and equipments which seem to offer the greatest promise for future sharing are all characterized by a very high dgree of engineering content. Canadian industry will be able to share in such production programmes only if its engineering capacity can be maintained and technical competence advanced through the performance of appropriate development tasks. Production sharing, in effect, pre-supposes development sharing. The government has therefore provided funds for the support of appropriate develoment work in this country, and, at the same time, the need for a close understanding and co-operative arrangements has been urged upon the United States Government.

Industry must readjust

Canadian defence industry is being asked to make a major readjustment in its outlook and operations. To a significant extent, it is a creature of protectionist policies, and, for the electronics industry at least, that protection was direced largely against the United States. Now, in effect, it is being asked to compete directly with the foreign industry from whose competition it has been shielded in the past, and on the latter's home ground. The magnitude of the task should not be minimized. There are, however, encouraging signs, as the Minister of Defence Production has stated, that the Canadian industry is beginning to adjust itself to the new defence environment, and already some success has been achieved in the radar, data processing and communications fields, in this highly competitive situation. The idea of production sharing is too new, and the accumulated experience is too limited to allow any very definite conclusions to be drawn as yet. Nevertheless, initial results appear to justify some optimism on the part both of the Department of Defence Production and of Canada's electronics industry. END

The hard sell is needed

Teamwork in a common venture can succeed only if the tasks are equitably shared.

The Canadian electronics industry must sell defense equipment to the United States for the joint defense of the two countries. Our strategic geographical position gives us the right to involve our military forces in a common defense. In a similar manner, it is our right to share in the development and production contracts necessary for a continuing defense program.

How to do it?

The "hard sell" by individual companies is the answer.

The EIA Government Liaison Committee can oil the wheels in Ottawa, the Canadian government wheels can roll across the border and turn in the United States, but ultimately it is up to the individual Canadian companies to knock on doors in Washington to sell their goods.

By the efforts of EIA and the government, not all these calls will be cold. Some warming up has already taken place to make the United States procurement agencies aware of Canada's economic capabilities and engineering knowledge.

Already the United States government has made concessions to enable Canadian companies to tender on a more equal basis with American companies. There are still legal anomalies to overcome. The formation of the EIA Defense Production Sharing Committee and its Sub-Committees, announced at the 30th Annual Meeting of EIA, will undoubtedly help to clear away these anomalies when the committee swings into action.

But the really big concentrated effort must come from the electronic companies in Canada. Some have already taken a lead by opening offices in the United States — a few are actually acquiring United States manufacturing facilities. Others are employing United States representatives who keep eyes and ears open for the first harkening of the issue of tenders.

As Prime Minister Diefenbaker says, we will not accept the crumbs; we are justified in asking for a large portion of the loaf. Our national survival and the survival of our electronics industry are at stake.

The hard sell is needed. Let us go to it.

Stuart D. Brownlee, President,
Electronic Industries Association of Canada.

Buy American Act

U. S. Services open doors to many items

The Buy American Act restriction for military procurement has recently been greatly modified in regard to Canadian supplies. Certain restrictions remain, but they are relatively mild.

The Buy American Act as passed in 1933 (Title III of the Treasury and Post Office Appropriation Act of 1934), requires that U.S. Government departments shall purchase only supplies that have been produced in the United States.

The Act does not apply to goods intended for Government use outside of the United States, nor to goods that are not produced in the United States in "sufficient and reasonably available commercial quantities and of a satisfactory quality". Further, the head of a Government agency is free to determine whether the restriction to U.S. sources is inconsistent with the public interest or whether the cost is unreasonable.

Co-operation becomes significant

In the years since 1933, U. S. - Canadian defense production co-operation has become an official policy of both governments. As a result, the U. S. Armed Services have made use of their right to find the Buy American Act restrictions as inconsistent with the closer defense production relationship to Canada. This has been done by each of the three Services; but to continue some measure of preference for U. S. supplies, varying degrees of restrictions against Canadian goods have been used throughout the years.

In the case of direct Service procurement with prime contractors these restrictions have usually taken a form similar to tariffs. That is, the Services added some factor to Canadian bids before comparing them to domestic U. S. bids. This procedure is designed for instances where a Canadian company is in competition with one or more U. S. suppliers. If a U. S. Service chooses to negotiate a contract with a Canadian company as a sole source, the Service has in effect waived all aspects of the Buy American Act.

Where the prime or sub-contractor considers incorporating Canadian supplies, the restriction has usually taken the form of limiting foreign content of the end item to less than 50%. Unless specifically instructed, the U. S. contractor has not been obliged to penalize Canadian competitive bids by the addition of any factors.

These obstacles for Canadian bidders in competitive procurement have been the essence of the Buy American Act as far as Canadian suppliers are concerned.

NEW U. S. SERVICE POLICY

The three U. S. Armed Services have now relaxed their restrictions and have adopted a common basic policy toward Canadian procurement. It is as follows.

Prime contracts

For a selected list of products considered to be of mutual interest to the United States and Canada, the Buy American Act is waived in respect to Canadian competitive bids or proposals for prime contracts. In other words, Canadian materials and products are considered to be U. S. goods for the purposes of the Act. The selected supplies concerned are listed below by U.S. Federal Supply Classification (FSC) Groups and Classes, abbreviations being used for the three Services, as follows: U.S. Army—A; U.S. Navy—N; U.S. Air Force—AF. Further information on these exemptions may be obtained from any DDP Production Branch, or from the Co-ordinator of Production Sharing.

In U.S. Service procurement of all other products, Canadian competitive bids for prime contracts will henceforth be evaluated by adding only the applicable U. S. duty to the Canadian bid. The U.S. Services are free to get a waiver of duty on goods imported for defense use. Whether they intend to take advantage of this waiver or not, they must add the tariff to your competitive bid for evaluation purposes.

Sub-contracts

If the supplies are for incorporation into one of the listed products, the Canadian goods are to be considered as U. S. material for the purposes of the Buy American Act. Thus, the U. S. defense contractor can theoretically buy anything up to 100% of his product from Canadian sources. Further, where the listed supplies are procured by the defense contractor as components rather than end-products and are being incorporated into end-products that may or may not be listed, if offered from Canadian sources, these components are to be considered as U. S. material.

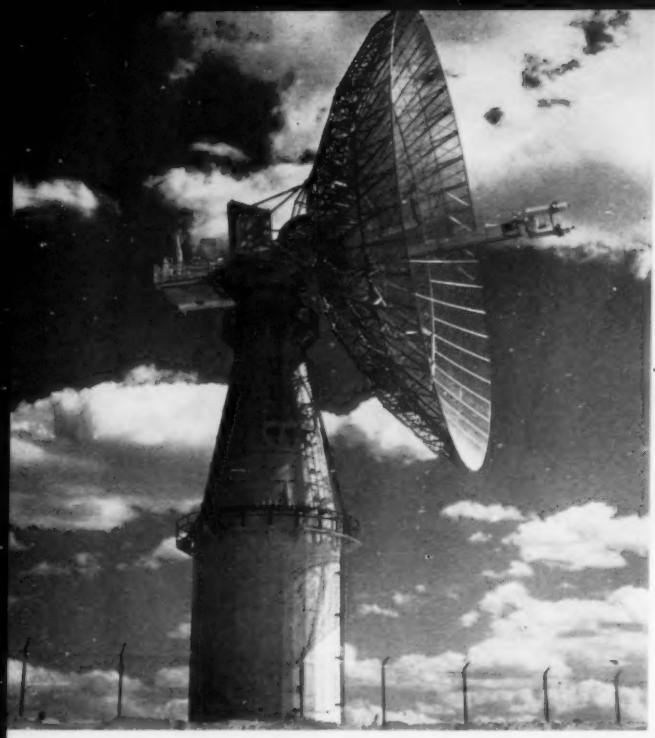
If the U. S. prime contractor is producing an unlisted product, he must keep the entire Canadian or foreign content below 50%, unless the Armed Service is willing to waive this stipulation in order to permit a larger foreign content in a specific procurement. However, if any of the Canadian components are listed supplies, they are to be regarded as domestic and are exempt from the foreign content limitations.

Research and development

The Buy American Act relates only to physical materials and is not concerned with contracts where the supplier delivers findings resulting from a research and development contract. If such a supplier also delivers prototypes or other hardware, the above regulations regarding Canadian suppliers apply. It is doubtful, however, whether the Buy American Act would be invoked to prohibit such articles under any circumstances, as they would be eligible for a waiver because of their non-availability in the United States.

Selected products

10. Weapons
    A: all classes.
12. Fire control equipment
    A: radar, except airborne.
    AF: fire control systems, aircraft gunnery & bombing fire control components, misc. fire control equipment.
14. Guided missiles
    A: components, remote control systems, launchers, N & AF: all classes.
15. Aircraft; and airframe structural components
    A: drones. N & AF: all classes.
16. Aircraft components and accessories
    A, N & AF: all classes.
17. Aircraft launching, landing and ground handling equipment
    N & AF: all classes.
29. Engine accessories
    N & AF: all classes.
49. Maintenance and repair shop equipment
    A: all classes. N: aircraft, ammunition, guided missile. AF: aircraft, fire control, guided missile.
58. Communication equipment
    A & N: all classes. AF: telephone & telegraph, teletype & facsimile, radio & television, radio navigation, intercom & public address, sound recording & reproducing, radar, visible & invisible light communication, misc. airborne equipment.
59. Electrical and electronic equipment components
    A, N & AF: all classes.
61. Electric wire; and power and distribution equipment
    AF: all classes.
63. Alarm and signal systems
    AF: airborne types.
66. Instruments and laboratory equipment
    A & N: all classes. AF: engine, flight and navigational instruments, automatic pilot mechanisms & airborne gyro components, electrical & electronic properties measurement & testing instruments.
67. Photographic equipment
    AF: all classes.
69. Training aids and devices
    A & N: all classes. AF: training aids; armament, communication & operational training devices.
74. Office machines and data processing equipment
    A: automatic data processing systems: industrial, scientific & office types.



Radar laboratory at Prince Albert, Sask. shows how . . .

Canada and U. S. pool talents for research project

J. E. HOGARTH, PhD*

Prince Albert Radar Laboratory (PARL) was first heard of by most Canadians at the time of its official opening by the Prime Minister of Canada on June 6, 1959 (CEE, July 1959, page 23). In addition to the presence of Mr. Diefenbaker, the opening was highlighted by a message from the President of the United States, radio-relayed via the moon from the Millstone Hill Radar near Boston, Mass., to the Prince Albert Radar. This feat, although by no means the first radio contact with the moon, was probably the first reasonably good quality voice transmission by that route.

The story of this research facility goes back to the 1954-55 period when the Intercontinental Ballistic Missile (ICBM) was becoming evident as a major potential threat to security. The continental nature of most concepts of defence against such a weapon naturally drew Canada and the United States into a state of intimate co-operation in defence planning. Fortunately, the groundwork for such co-operation was already well laid during the establishment of various early-warning anti-aircraft radar networks which now span this country.

Common sense dictated that proper co-ordination must begin at the research level. One of the areas of research in which Canadians have been leaders has been that pertaining to the upper atmosphere, in particular the ionosphere. This is a natural consequence of the fact that most of the significant auroral and other disturbances which occur in the ionosphere over the land masses of the world are within the boundaries of Canada. These disturbances have long resulted in special problems of radio communication to Canada, especially in the hf band. In addition to the Defence Research Board's Telecommunications Establishment (DRTE), the National Research Council, the Dominion Observatory, and the University of Saskatchewan's Institute of Upper Atmospheric Physics have made notable contributions to this field of science.

In the past few years the immediate and practical importance of research on the upper atmosphere has increased at a tremendous rate. In radar detection, for example, where a few years ago one was concerned with relatively large targets at most a few hundred miles away in the lower atmosphere, current targets (missiles, satellites, etc.) are generally much smaller, faster, and higher, and appear at ranges of perhaps thousands of miles. The problems of radar propagation have therefore increased by several orders of magnitude, brought about by the necessity for a tremendous increase in radar sensitivity and the fact that the new propagation medium (i.e. the ionosphere) has exceedingly complex electromagnetic properties.

In earlier days of radar design, engineers tended to ignore anomalous propagation factors. Today these factors are given a high priority in design considerations.

Aurora yields uhf echoes

The greatest stimulation to radar propagation research came early in 1956 when the somewhat unexpected discovery was made that the electrified upper atmosphere associated with the aurora yielded radar echoes in the uhf band, an otherwise excellent part of the spectrum for high power radars. Previously, a great deal of research had been carried out on auroral echoes in the lower vhf band, and an incomplete understanding of the reflecting mechanism led to an erroneous extrapolation that higher frequencies would be relatively free of such clutter.

Since 1956, extensive research has been carried out on uhf auroral echoes at MIT'S Lincoln Laboratory, at Stanford Research Institute, and at DRTE, in each case using medium or low power radars. Lincoln Laboratory later completed the powerful Millstone radar, with its satellite tracking capability and its recent achievement of having made radar contact with the planet Venus. The Millstone radar is playing, and will play, an important role in radar propagation research, but its many commitments and its

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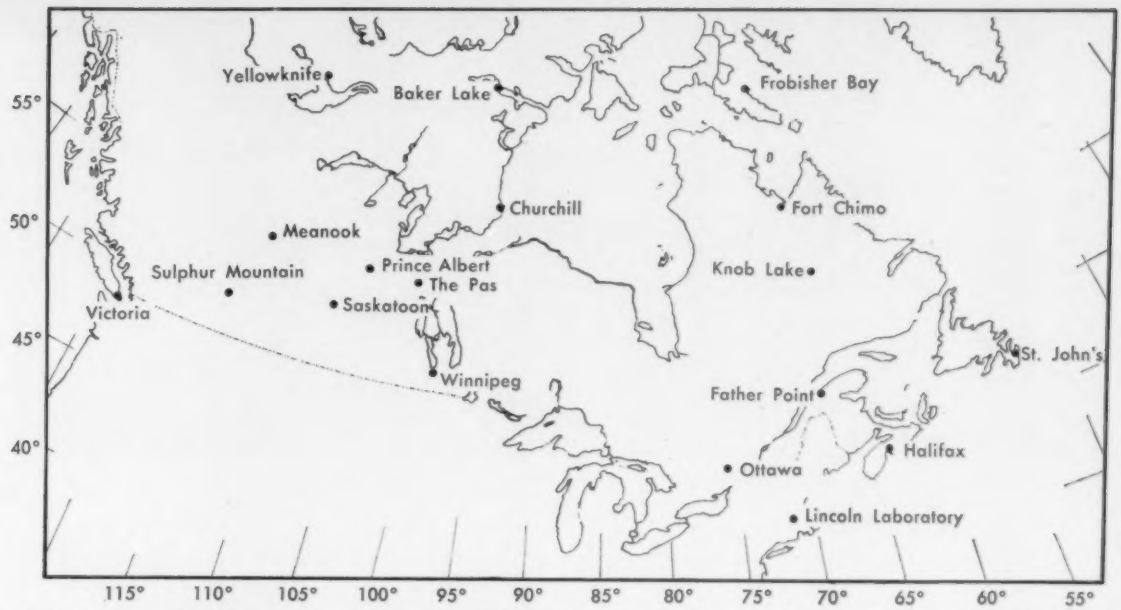

A site for the radar laboratory was chosen near Prince Albert, Sask., because it is near, but not under, the belt of maximum auroral disturbance. The site is also near the ionospheric research facilities at Churchill and Saskatoon.

location far to the south of intense and frequent auroral activity render its usefulness incomplete in this regard.

In 1956 the United States Air Force became interested in having a high power radar of the Millstone type placed in Canada to be used as a research tool in support of the North American anti-ICBM defence program. Several discussions between USAF and DRB ensued, and with the enthusiastic support of the management and scientific staff of Lincoln Laboratory, a workable plan evolved. In the summer of 1957 an arrangement was established between USAF and DRB whereby approximately two million dollars would be provided by USAF to Lincoln Laboratory for the purpose of procuring a radar more or less identical to the Millstone radar, and installing it at a Canadian site to be chosen by DRB. Building and other site facilities would be provided by DRB. It was further agreed that DRB would undertake a minimum five-year period of radar propagation research. MIT's Lincoln Laboratory and DRTE would be the active participants.

This arrangement has been a remarkably happy one. All the details were left to be worked out by the participants, who, in spite of their markedly different administrative structures, worked as a cohesive unit in bringing about the completion of the installation phase of the project.

Selecting the site

The first task which faced DRTE was the choice of a suitable site. The radar should be able to view, at low angles of elevation, regions of frequent auroral disturbances (the maximum belt corresponds roughly with 60 deg. latitude in central Canada). Also, because of extensive ionospheric research and rocket programs associated with Fort Churchill, Manitoba, it was desirable to locate somewhere on an arc roughly between five and six hundred miles from Churchill. Other considerations included proximity to Saskatoon's Institute of Upper Atmospheric Physics, the normal problems of logistics and power, available housing facilities for the staff, and freedom from obstruction over a complete hemisphere. For reasons of safety, and elimination of possible sources of mutual interference, it was desirable to have control over a radius of several hundred yards.

An initial survey was made in 1956, over an arc extending from Yellowknife to Winnipeg. The area of Prince Albert was tentatively selected, but without locating a suitable site in detail. In 1957, more detailed surveys were made of abandoned airfields, army camps and other property under the control of the Department of National Defence, located between Prince Albert and Winnipeg. Each site in turn was abandoned for one reason or another.

Finally, the Department of Natural Resources of the Province of Saskatchewan offered a site in the undeveloped woodland area to the north of the North Saskatchewan River in the vicinity of Prince Albert. This area was not mapped in detail, but with the aid of an RCAF helicopter an excellent site was finally selected.

By late 1957, the project was moving rapidly. One minor crisis developed when it was realized that the mild steel normally used for such construction as the antenna mount probably would not withstand the severity of a Saskatchewan winter. This steel suffers a transition at cold temperatures which drastically reduces its resistance to impact. It is worth noting here that the horizontal bearing of the antenna mount supports a weight in excess of 90 tons, and that in addition the wind loading on the 5,500-sq. ft. reflector can be considerable. The Physical Metallurgy Division of the Canadian Department of Mines and Technical Surveys was instrumental in the selection of a steel with adequate low temperature characteristics.

Construction was completed by early autumn, 1958, and installation of the equipment got under way. Transportation of the radar equipment from the various points of manufacture across the American continent was something of a problem. For example, the expensive 10-ft. long klystron tubes were shipped from California by specially chartered air freight; the reflector occupied the space of 34 railway box-cars; one large item 12 feet wide and weighing

Directing operations in the control room, above, is the officer-in-charge, D. R. Hansen, third from left. The staff of PARL comprises 10 scientists and technical specialists from DRTE, plus 5 supporting personnel from Prince Albert.

18 tons was shipped from Boston to Prince Albert by truck, having to utilize the North Battleford bridge, some 100 miles to the west of Prince Albert, in order to cross the North Saskatchewan River.

Erecting the antenna was major operation

The most interesting phase of the installation was that pertaining to the antenna system. Over 100 tons of materials in units ranging up to 18 tons had to be hoisted to about 100 feet above ground and carefully fitted together. The formula called for two 35-ton cranes with 110-foot booms. Toronto was the closest Canadian source of such equipment, and the cost, for a few days use, would have been out of proportion to the services obtained. A neat and satisfactory solution was produced by Lackey Brothers Ltd. of Waterloo, Ontario, who did the job with one smaller crane and a 40-ton rectangular A-frame with a 30-foot span. The task was completed in December, 1958.

The PARL antenna is a masterpiece of rugged but precise mechanical engineering. Driven in azimuth and elevation by four 30-hp motors, its 2 deg. conically scanning pencil beam will track a distant target to an accuracy of 0.1 deg. The reflector is 84 feet in diameter, and can be rotated in any direction at 4 deg. per second. Only two seconds are required to reverse direction at full speed.

Installation of the huge transmitter and the complex receiving equipment has just recently been completed. This equipment is contained in a building of approximately 15,000 square feet. In full operation the system consumes 1,000,000 watts of electrical power.

A necessary feature of any modern radar is an integrated system for displaying, storing and analysing the vast quantities of data which can be made available. The Prince Albert Radar is capable of collecting a staggering amount of data for research purposes.

The Electronics Laboratory of DRTE has designed and is completing the fabrication of a flexible special purpose computer which is matched to handle the PARL data. This computer, entirely a solid state device (4,000 transistors; 18,000 diodes; 40,000 bits of magnetic-core random-access memory), will organize and label the radar data and store it on magnetic tape at a rate of 75,000 binary bits per second. Later the same computer can carry out certain types of data processing; in all cases the magnetic tape outputs are coded and organized in such a manner as to be used directly by large commercial general purpose computers for final analysis of the data. END

At the official opening of PARL, DRTE scientist Dr. J. H. Chapman, left, explained operation of the equipment to Prime Minister Diefenbaker, centre, and His Excellency R. B. Wigglesworth, U.S. Ambassador to Canada, right. Second from right is Dr. A. Zimmerman, Chairman DRB.

Special purpose buffer computer, designed and built by DRTE, will assimilate data from the radar at rates up to 77,760 bits per sec. Demonstrating it is J. Miedzinski.

Canadian electronic resources for integrated defence production

This CEE Feature Report includes detailed information on the products and facilities of almost 150 Canadian electronics and associated companies. It is the sincere hope of your editors that it, together with the other features in this special issue, will assist our American readers to more fully assess the defense capabilities of the Canadian electronics industry. We also expect that it will be a very useful reference source for our regular Canadian readers.

The information has been compiled from the results of a survey made by CEE. We wish to thank sincerely those companies that helped by returning completed questionnaires, and the personnel of the Electronics Branch of the Department of Defence Production, who helped to fill in the gaps. Every effort has been made to cover the industry as completely as possible; however, there are some companies on which complete information was not available when we went to press.

The index below is arranged in three sections: Equipment, Components, and Materials & Services. A brief description of each company's relevant products follows its name, together with the number of the page where the complete listing appears. The listings, starting on page 45, are in alphabetical sequence, and include photographs of typical Canadian defense products and facilities.

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Acme Electric Corp. Ltd., 50 Northline Rd., Toronto 16, Ont. PL. 5-3315. J. H. McKechnie, general manager.

Associate: Acme Electric Corp., Cuba, N.Y. and Hawthorne, Calif.

Products: Transformers for electronic applications such as automation controls and regulators, aviation installations, computers and business machines, electronic instruments, guided missiles and ground control, radar, radio and telephone communications. Units designed to meet specific mechanical, electrical and environmental specifications. Also coils and solenoids, power supplies, rectifiers, battery chargers, motor controls.

Facilities: Single story brick building, 16,500 sq ft. Complete equipment for winding, assembling and testing. Test equipment and procedures are in line with DND Inspection Services requirements. Average 75 employees, including 3 design engineers and 2 skilled laboratory technicians.

R & D: Design engineers and other technical personnel experienced in developing new products. Access to facilities of associate company, which maintains permanent development staff under Dr. E. Moyer.

Addison Industries Ltd., 40 Queen Elizabeth Blvd., Toronto 18, Ont. CL. 9-9234. E. R. Mitchell, vice-president and general manager.

Products: Wide range of domestic radio and television receivers and phonographs, also other types of electronic communications and measuring equipment. Present products include the AN/PRC 509 & 510 portable fm radio sets for voice communication, and line-to-line and line-to-loudspeaker type audio amplifiers. Previously manufactured the portable transmitter-receiver set 58 Mark I Star/T.

Facilities: One story brick building, 60,000 sq ft. Full machine shop, assembly area and supporting facilities. Test and quality control procedures approved by DND. Plant is electrically protected, with security patrols now being established. Personnel totals 250, including 25 administrative, 10 engineering.

R & D: Engineering Department has previously developed communications equipment to Service requirements in co-operation with DDP and DND, and is prepared to undertake similar projects related to the types of product mentioned above.

Aerovox Canada Ltd., 1551 Barton St. E., Hamilton, Ont. LI. 5-1186. James Key, general manager.

Parent: Aerovox Corp., New Bedford, Mass.

Products: Complete range of types and sizes of fixed capacitors. Mica molded—standard, silvered, transmitting. Ceramic—disc, tubular, temperature-compensating, subminiature. Paper—tubular, metal-cased, oil-filled. Also filter and suppression types and electrolytics. Units have been supplied for various types of land and airborne military equipment, including walkie-talkie sets, army vehicle noise suppression, radar and general communications.

Facilities: Brick tile construction building, mainly single story, but with administrative and engineering offices on second floor at front. 70,000 sq ft, including 40,000 manufacturing; 7,500 administrative and engineering; 7,500 stores; 15,000 maintenance and auxiliary services. Entire property enclosed by chain-link fence. Fully equipped with special capacitor manufacturing machinery, including electrolytic formation equipment, impregnation facilities, winding and assembly machines, jigs and fixtures. Test department equipped with capacitance, power factor and Q meters and bridges, vibration test equipment, heat/voltage life test, humidity and cold chambers, voltage supplies, etc. Approved by DND. Personnel include 6 in management group, 4 engineers, 3 technicians, 10 other key staff. Clerical, semi-skilled and unskilled total 200.

Aircraft Appliances & Equipment Ltd., 585 Dixon Rd., Box 177, Weston, Ont. CH. 4-5506. L. V. Myslivec, president.

Products: Rotating and static power supplies, magnetic amplifier regulators and electrical test equipment. Also act as Canadian distributor for aircraft rotating electrical equipment, relays and antenna systems.

Facilities: One-story steel and brick building, 28,000 sq ft, including 4,000 sq ft machine shop and 10,000 sq ft assembly area. Variety of lathes, milling machines, sheet metal working and welding equipment. Inspection department has full range of electrical test equipment, quality control procedures being approved by RCAF. Personnel total 70, including 16 administrative, 6 engineers, 15 skilled manufacturing, 25 skilled repair and overhaul technicians, 5 quality control and inspectors.

R & D: Can handle R & D projects on relays, power supplies and test equipment with present engineering staff, plus reputable consultants if necessary.

Airtron Canada Ltd., 349 Carlaw Ave., Toronto 8, Ont. HO. 1-3511. E. D. Smith, general manager.

Affiliate: This is a Canadian owned and operated company, but is licenced as to patents and processes by Airtron, Inc., division of Litton Industries, Morris Plains, N.Y.

Products: All waveguide equipment, components and accessories manufactured by Airtron, Inc. Company has also engineered and produced many newly-developed items during the past two years. Waveguide items have been produced for the following defense projects:—

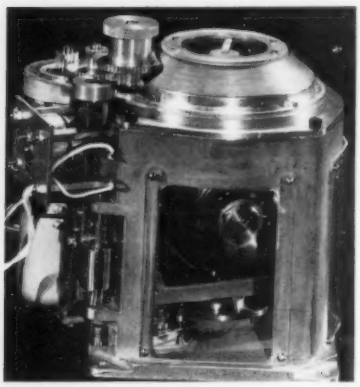
Automatic telephone switching equipment—Automatic Electric (Canada)

Canadian resources

APG-30, APG-501, APS-33, APS-38 airborne radars; FPS-3, FPS-6, FPS-20, AN/CPS-6B ground radars; Sparrow II missile; Sabre, CF-100, CL-28, CL-44, CF-105 aircraft.

Facilities: One-story brick and cement building total 27,000 sq ft, of which about 10,000 sq ft is available for expansion. Manufacturing area is equipped for aluminum casting, plating, vinyl coating, rubber molding, painting and baking, together with normal machine shop equipment. Also have access to the facilities of Renfrew Electric Co. Ltd. Complete facilities for quality control and inspection include a high-power test set complete with vacuum table, manometers and power meter; swept frequency set-up for VSWR measurement; slotted line method for VSWR and attenuation measurements; test set-up for measurement of coupling and directivity of directional insertion loss and isolation of ferrite devices; system noise measurement equipment; equipment for measuring magnetic fields for isolators and ferrite devices; pressure testing; environmental test equipment. Present staff is 27, including 3 engineers and 3 quality control inspectors.

R & D: The facilities of Airtron Canada Ltd. have been approved by CAMESA for in-plant testing of waveguide items. Equipment used for quality control and inspection is also used for research and development of new components.



Course control — Aviation Electric

Allen-Bradley Canada Ltd., 135 Dundas St., Galt, Ont. Galt 4660. Bruce E. McAndrew, office manager.

Parent: Allen-Bradley Co., Milwaukee, Wis.

Products: Canadian company manufactures switchgear and motor controls. Parent company also manufactures resistors; these may be manufactured in Canada at a later date.

Facilities: Brick building of 43,000 sq ft of which 38,000 are devoted to manufacturing, repair and overhaul and storage. Employees number 187, of whom 14 are in the engineering department and 9 in quality control and inspection. Manufacturing area is equipped for metalworking, welding, paint spraying and baking, with remaining space used for assembly and test.

Allied Circuit Techniques Ltd., 29 Brock St., Oakville, Ont. VI. 4-9411. T. W. Denzey, direcor.

Affiliate: Photo Color Process Corp., East Rochester, N.Y.

Products: Design from schematic diagrams and manufacture of all types of printed circuits, flush plated on all materials. Also, encapsulation of miniature modules in epoxy resins and polyesters. Company plans to manufacture completely assembled packaged circuits, including tests to military specifications.

Facilities: 6,500 square feet on one floor in well-lit cement block building, prime manufacturing areas being maintained dust-free. Fenced with provision for full security protection. Complete equipment is maintained for photography, film processing, sensitive film coating, type-setting, and electro plating (tin-lead, copper, nickel, silver, nickel-rhodium, gold, beryllium). Machine shop, silk screen and marking facilities are also included. Personnel comprise two management, one design engineer, six employees specially trained in the manufacture of printed circuits, including one full time quality control checker with adequate instrumentation. Training facilities are available for new employees.

R & D: It is proposed to set-up study programmes under the guidance of Mr. T. W. Denzey, Assoc. Brit. I.R.E., on component redesign for more versatility, miniaturized circuits in the micro-modular form, evaluation of ing to natural materials. R & D contracts will be sought in these areas.

Amcan Electrical Harness Ltd., 1139 King St. W., Toronto 3, Ont. LE. 2-9002. J. A. Vanstone, president & general manager.

Products: Cable assemblies of all types, particularly for computer and similar applications.

Facilities: 3,500 sq ft of assembly area. Personnel comprise 2 male technical employees and 22 skilled female assemblers, including one full-time inspector.

Amphenol Canada Ltd., 349 Carlaw Ave., Toronto 8, Ont. HO. 1-3511. J. E. Partridge, general manager.

Affiliate: Amphenol - Borg Electronics Corp., Chicago, Ill.

Products: AN, rf, rack-and-panel, and special military multi-contact connectors. Also, coaxial and twin-lead cable. Starting in 1943, the company manufactured connectors for military applications only during the war period, re-starting in 1955 as a full connector and cable manufacturing operation.

Facilities: Cement building of 29,500 sq ft, including 20,000 sq ft manufacturing area. Machine shop, plating and test equipment supports the special machines used for connector and cable manufacture. In addition, the full tool-room facilities of Renfrew Electric Co. Ltd. are available. Test equipment includes high and low temperature and corona cabinets, together with appropriate electric and electronic test gear. Present personnel total 70, including 50 production workers, 15 administrative, 3 engineering and 2 quality control and inspection.

R & D: Prepared to undertake the development of special types of connector for military and other applications.

Andrew Antenna Corp. Ltd., 606 Beech St., Whitby, Ont. MO. 8-3348 and Toronto EM. 4-1972. R. P. Matthews, manager.

Affiliates: Andrew Corp., Chicago, Ill. and Andrew California Corp., Claremont, Calif.

Products: All forms of antennas, antenna systems, transmission lines and waveguides. Have produced these types of equipment for the Mid-Canada and Pinetree early warning lines, and for phases I and II of the ADCOM system.

Facilities: One-story steel, brick and glass building, 6,000 sq ft, with 18 ft ceiling. Also 14-acre antenna pattern range. General machine shop tools, and complete facilities for welding and painting. Quality control is part of engineering department, procedures approved by DND. Employees total 30, including 2 administrative, 7 engineering, 20 productive.

Arrow-Hart & Hegeman (Canada) Ltd., Industry St., Mount Dennis, Toronto 15, Ont. RO. 2-1101. G. F. Hooper, managing directo.

Parent: Arrow-Hart & Hegeman Electric Co., Hartford, Conn.

Products: Wiring devices, motor controls, toggle switches for appliance and electronic applications.

Facilities: Two story brick building, 30,000 sq ft. One floor devoted to assembly, also adequate tool room, press shop, etc.

Audio Transformer Co. Ltd., 202 Regina St. N., P.O. Box 579, Waterloo, Ont. SH. 3-4351. J. G. Hutchison, president & general manager.

Products: Small iron-core transformers for the radio and television industry.

Facilities: Hollow tile construction building, 20,000 sq ft. Approximately 130 employees.

Automatic Electric (Canada) Ltd., 100 Strowger Blvd., Brockville, Ont. DI. 2-6621. S. C. Baird, vice-president and general manager (sales).

Parent: General Telephone & Electronics Corp., New York, N.Y. Affiliate: Canadian (B. C.) Telephones & Supplies Ltd., Vancouver, B.C. (installation organization). Sales handled by Automatic Electric Sales (Canada) Ltd., with offices in principal cities across Canada.

Products: Electro-mechanical and electronic equipment for telecommunication purposes; also electrical control apparatus, including relays and stepping switches for any purpose. Present products include dial telephone switching equipment, automatic and manual toll switchboards, private automatic telephone exchanges, Strowger automatic toll ticketing equipment, manual and dial telephone instruments, relays, stepping switches, and power equipment, for communication systems. Military products have included special relays and automatic telephone exchanges, field telephone and asdic recorders.

Facilities: One story brick building built in 1954 includes 185,000 sq ft manufacturing area and 30,000 sq ft engineering and administrative area. Fully fenced and sprinklered with 24-hour company police guard, also hourly telephone check with local police office during off-shift periods. Plant is fully equipped with adequate machine tools, metal working equipment, coil winders, furnaces and painting equipment. Inspection department is well equipped to check small parts and gauges and has a wide range of electrical and mechanical test equipment. Additional facilities include tool-room, chemical laboratory, and equipment for metallography.

Personnel total approximately 1,100, including 82 administrative, 16 engineering, 492 manufacturing, 58 repair and overhaul, 117 quality control and inspection, and 244 in stores, packing and shipping.

R & D: Depend mostly on close liaison between the company's engineers and the research and development staff of the General Telephone Laboratories, North Lake, Ill.

Aviation Electric Ltd., 200 Laurentian Blvd., Ville St. Laurent, Montreal 9, Que. RI. 4-2811. C. D. Garbutt, sales manager.

Affiliates: Bendix Aviation Corp., Detroit, Mich. Aviation Electric Pacific Ltd., Vancouver Airport, Vancouver, B.C.

Products: Full range of flight instruments, direct and remote reading indicators, amplifiers, gyros, accelerometers, specialized hydraulic and pneumatic equipment, electrical and electronic test equipment. Present products include dc turn and bank indicators, bourdon tube and diaphragm sensing elements, navigational servo coupling devices, ball resolvers for navigational and computation equipment, electrical actuators, survival equipment, pneumatic control valves, hydraulic control units, gyro torpedo course controls, autopilot and other test stands, accelerometers, rate gyros, and gyro radar antenna.

Facilities: Two story modern brick building, 155,000 sq ft. Fenced, illuminated at night, and patrolled by company police on 24-hour basis; fully approved by Industrial Security Branch, DDP. Full manufacturing and overhaul facilities supported by tool room, machine shop, assembly shops, test equipment shop, hydraulic test-laboratory, fuel control test laboratory, heat treating and electroplating facilities, chemical and metallurgical laboratories, standards room (metrology and electrical), and an engineering department. All inspection departments, standards rooms and the chemical and metallurgical laboratories form part of the Quality Control department. The organization and performance of this group is surveilled and approved by the RCAF.

Personnel total 800, including 212 management, supervisory, clerical and maintenance; 115 engineers, technicians and other technical staff; 325 skilled and 71 semi-skilled production workers. Continuous training is provided for instrument mechanics, and the company has extensive educational assistance programs.

R & D: A fully-qualified staff of engineers are supported by test facilities. These include hydraulic environmental test from -65 to +450 deg F, ambient and oil temperatures independently controlled, 0 to 4,000 psi at 20 gpm, 0 to 10,000 psi static. Also fuel control test facility and instrument environmental test equipment including temperature, humidity, shock, vibration and acceleration.

Bayly Engineering Ltd., Hunt St., Ajax, Ont. Toronto EM. 2-3741. H. F. Philp, managing director.

Products: High-, low- and band-pass telegraph and communications filter networks; coils and transformers, including toroidal types; subminiature delay lines; rf, power monitors and dummy loads; test sets; telephone jack assemblies; instrument overhaul and calibration.

Facilities: Plant area 30,000 sq ft, including 3,000 for engineering dept. and 8,000 for laboratory. Test and development facilities include general purpose electronic equipment covering the range from dc to X-band. Standards are maintained for voltage and resistance.

R & D: Most of the company's products are developed, engineered and manufactured to meet specific customer requirements.

Beaconing Optical & Precision Materials Co. Ltd. Head Office: 455 Craig St. W., Montreal, Que. UN. 6-8395. T. Toczylowski, vice-president. Plant: 555 Blvd. Boivin, Granby, Que.

Subsidiary: General Precision Industries Ltd., same addresses.

Products: Custom-made electronic and optical equipment, radio direction finders, microwave links and systems, automatic and semiautomatic sorting systems, precision mechanical and radar components and assemblies, gear trains. Have produced ship-borne remote radio control systems, modifications of naval binoculars, range-finder sights for rocket launchers. Interested particularly in producing items for which component design, inventive engineering and skilled craftsmanship are required.

Facilities: Two brick and concrete buildings, total 30,000 sq ft, including design office, electronic and optical laboratories, precision machine shops, facilities for assembly of electronic, optical and mechanical apparatus, bonded storerooms. Own quality control laboratory is well staffed and equipped; also have two resident DND inspectors, one for electronics and the other for optical and mechanical work. Plant has full 24-hour security protection, approved by DDP. Employees total 80, including 12 engineers, 15 administration, 53 skilled craftsmen and other production workers.

R & D: Subsidiary General Precision Industries is capable of carrying out research and development projects in their specialty — radio direction finding, as well as in microwave systems.

Bishop Sons & Co. Ltd., 588 Eastern Ave., Toronto 8, Ont. HO. 3-1213. G. H. Bishop, president.

Products: Specialists in high-class electronic sheet metal work, including cabinets, consoles, panels, racks, chassis, etc. Have supplied custom-made products to firms such as Collins Radio Co. of Canada Ltd., Philco Corp. of Canada Ltd., de Havilland Aircraft of Canada Ltd., Canadian General Electric Co. Ltd., etc.

Facilities: Brick and reinforced concrete building; 9,000 sq ft, of which 8,000 are devoted to manufacturing. Complete facilities for sheet metal work, including precision hole-punching machines and equipment for joining and finishing most metals (steel, stainless, monel, Inconel, copper, brass, aluminum, magnesium). Three administration, 12 production and 5 other employees.

Bogue Electric of Canada Ltd., Box 900, Stn. "B", Ottawa, Ont. TA. 2-2380. J. G. Knowlton, president.

Products: DC and 400 cps rotary power supplies, naval switchgear.

Facilities: Plant area 80,000 sq ft; 50 employees.

The Brunswick-Balke-Collender Co. of Canada Ltd., 40 Hanna Ave., Toronto 3, Ont. LE. 3-3501. B. E. Beinsinger, president.

Parent: Brunswick-Balke-Collender Delaware Corp.

Products: Rigid fiberglas reinforced plastic radomes for ground and airborne use; structural aircraft components in reinforced plastic.

Facilities: Total area of 132,000 sq ft includes 800 for engineering and 650 for laboratory. Production equipment includes 16 ft by 20 ft by 10 ft curing oven, two 100-ton platen presses, 75-ton compression molding press and machine shop facilities. Test equipment comprises 150,000 lb capacity testing machine, physical and chemical analysis apparatus, dimensional checking equipment and a radar test range. Production supervision and inspection personnel have clearance to Secret level.

Campbell Mfg. Co. Ltd., 45 Sheppard Ave. E., Willowdale, Ont. BA. 1-3415. M. A. McInnis, sales manager.

Products: Head-sets, microphones, loudspeakers, electronic cable and cord assemblies and harnesses.

Facilities: Total plant area 40,000 sq ft; 145 employees.

Canada Wire and Cable Co. Ltd., Postal Stn. "R", Toronto 17, Ont. HU. 5-8681. E. M. Durham, export manager.

Affiliate: Telecables & Wires Ltd., Postal Stn. "C", Winnipeg, Man. (manufacturers of a full line of telephone and communications wire and cables).

Products: A complete line of power and communications wires and cables, using every type of insulation. Magnet wire is made with 54 different types of insulation, many of which meet existing military specifications. The wire rope division manufactures a complete line of steel wire ropes, wire rope slings and fittings. Wire and cable can be manufactured to meet any military specification.

Facilities: Total of approximately 3,500 employees at Head Office and Main Plant, Leaside, Toronto; Branch Plants at Montreal, Que. and Fort Garry, Man.; Magnet Wire Div., Simcoe, Ont.; Wire Rope Div., Smiths Falls, Ont. All plants have the most modern equipment for manufacture and test of their products, and there are also extensive development laboratory facilities. Plants have met all DND security requirements during and since World War II, and are approved by DDP. Quality control inspection is carried out on all raw materials, in-process products and finished goods.

R & D: Equipped and staffed to carry out R & D projects on all power and communications cable and wire types; for example, test range facilities go up to 7,000 volts and down to —100 deg F.

Canadian Admiral Corp. Ltd., 501 Lakeshore Rd., Port Credit, Ont. CR. 8-5561. G. L. Irvine, manager, electronic products division.

Parent: Admiral Corp., Chicago, Ill. Other subsidiaries of the parent company are Admiral Corp. Advance Research Division, Palo Alto, Calif. and Midwest Mfg. Co., Galesburg, Ill.

Products: Television and radio receivers, record players, ranges; military electronic assemblies including tri-service multimeters type ME-77A/U, shunts and multipliers. The company has also produced power supplies for Canadian Arsenals Ltd., indicators type BC-727 for the RCAF, and transistor telephone amplifiers, type 5805-348-800 for the RCN. In addition, Canadian Admiral is the authorized Canadian representative of its parent company in the U. S., which has produced a wide variety of military equipments for the United States Government, some of which have been and are being used by the Canadian Services. There are excellent cross-over and liaison facilities between the two companies.

Facilities: One-story brick and block building, 135,000 sq ft, of which about 95,000 is devoted to manufacturing and 7,400 to engineering and laboratory. Plant security guards are on duty at all times, periodic inspection being completed throughout the plant on a 24-hour basis. Security measures have been approved and key personnel are cleared to Secret or Confidential by DDP. Complete facilities for assembly of all types of electronic equipment, with an inspection department well-equipped for production testing at all stages of assembly. A separate quality control section is maintained for life testing on a statistical basis. Personnel include 152 administrative, 15 engineering, 232 manufacturing and 25 inspection.

R & D: Engineering laboratory has a very comprehensive range of electrical and electronic test equipment and instrumentation.

Canadian Applied Research Ltd. (CARL), Head office and manufacturing plant: 750 Lawrence Ave. W., Toronto 19, Ont. RU. 1-1571. E. R. Johnson, contracts manager. Engineering Division, 1500 O'Connor Dr., Toronto 16, Ont. PL. 9-2241.

Parent: A. V. Roe Canada Ltd., Malton, Ont.

Products: Engineering and manufacture of electromechanical, electronic, optical and photographic equipment, de-icing systems, radio altimeters, air-borne navigation systems, air-borne survey and radar equipment, etc. Also complete facilities for repair and overhaul of oxygen equipment and all aircraft instruments, and a comprehensive environmental testing laboratory. Environmental test facility is used for the company's own products and is also available to other companies for tests to their own or to military specifications.

Current contracts for the supply of equipment to the United States include ice detectors for the Lockheed Electra, the Convair 880 and the Northrop T38 jet trainer. The de-icing controller for the Convair 880 has been developed and is being produced by CARL and a considerable quantity of tri-film processors and cameras has been sold to various U.S. companies and government agencies. The Airborne Profile Recorder (recording radar altimeter) has been sold to both WADC and to Lockheed (for the reconnaissance version of the C-130).

Facilities: Approximately 90,000 sq ft in modern two-storey building. Production department is claimed to be one of the best staffed and equipped in Canada for the production of electronic and electro-mechanical controls and systems, with a good reputation for meeting delivery schedules. It includes a section skilled in most methods of plastic molding and fabrication, with experience in the handling of special resins for encapsulation and impregnation. The plant has been cleared to Secret and is protected by a security guard system.

The environmental laboratory occupies 3,000 sq ft and is equipped to test to both military and commercial specifications. Basic electrical, hydraulic and pneumatic supplies are available, and equipment is included for carrying out the following tests or combinations of them: high temperature, low temperature, humidity, altitude, vibration, shock, explosion, sand and dust, salt corrosion, fungus, and radio interference. The company also has a complete publications department, equipped and staffed for technical writing, illustration and printing. This department's services are also available to other companies.

R & D: The Engineering Division staff numbers between 60 and 70, including many highly qualified scientists and engineers. In addition to the environmental and other laboratories operated by the company, the Division also has access to the computation centre of an associate company. This facility has, in addition to the normal complement of analog computers, an IBM 704. The staff also works closely with the National Research Council of Canada, whose staff and facilities are available on a consulting basis. The Division is thus well equipped to develop and design new products in the areas mentioned above.

Canadian Arsenals Ltd., Box 717, Ottawa, Ont. CE. 2-8211. J. H. Berry, general manager (Local 2-3765). Plants at Quebec City (2), Val Rose, Lindsay, Long Branch, St. Paul L'Ermite, Valleyfield, Scarborough.

Canadian Arsenals Ltd. is a Crown Company created in 1945, comprising a head office in Ottawa and six manufacturing divisions. The following information relates to the Instrument and Radar Division at Scarborough, Ont.

Products: Precision and optical instruments such as fire-control instruments, binoculars, collimators and directors, range finders, lenses, prisms, sights, telescopes. The Electronic Dept. assembles and manufactures parts for both fixed and mobile radar and carries out radar development and testing.

Facilities: Modern plant opened in August, 1952, 200,000 sq ft, with facilities for large-scale production of radar equipment, radio transmitters and controls, and other military electronic equipment and sub-assemblies. Also equipped for manufacture of optical and fire-control instruments (air-conditioned area), lens grinding and prism manufacture, together with automatic machines for ultra-small production parts and other machine tools. There are extensive engineering development and quality control laboratories, the latter being available to other agencies for the performance of environmental tests to military specifications on electrical and electronic components and equipments. Employees number 426, including the engineering department.

R & D: The Instrument and Radar Division is fully equipped and staffed to carry out extensive radar research and development projects.

Ruggedized tri-service multimeter — Canadian Admiral Corporation Ltd.

Canadian resources

Canadian Aviation Electronics Ltd., 6214 Cote de Liesse Rd. (Box 2030, Station "O"), Montreal 9, Que. ME. 1-6781. R. W. Cooke, vice-president, program development (Local 313).

Affiliates: CAE acts as Canadian representatives for Hughes Aircraft Co. (MG-2 fire control systems) and Fenske, Fedrick & Miller (automatic plotting display systems).

Products: Flight simulators, flight and tactical trainers; electronic and mechanical components; repair and overhaul of telecommunications, fire control, radar and electronic test equipment; field maintenance of electronic installations; installation of telecommunication and radar equipment; consulting services on electronic equipment; manufacture and repair of electronic process control, radiation and other measurement instruments.

The company has performed installation, repair and overhaul, and field service work for the RCAF, the USAF and the Belgian Air Force, including installation and electronic maintenance on the Pine Tree and Mid-Canada Lines and overhaul of MG-2 fire control systems. Flight simulators and trainers have been designed and manufactured for a variety of commercial and military aircraft, including the CF-100 and the CL-28.

Facilities: Brick and concrete building with total area of 150,000 sq ft, with fully-approved security arrangements. Assembly areas and machine shops are adequately equipped for the production of the products listed, air conditioned areas for the assembly and test of precision electro-mechanical units being provided. There are also full sheet-metal, plating and woodworking facilities. Total personnel are in excess of 1,000, including an Engineering Dept. with a staff of 182.

R & D: The Engineering Dept. has developed complex flight simulators and trainers, and is carrying out further development work of a similar nature. In addition to complete electrical and electronic test equipment and a standards laboratory, there is a PACE analog computer which, when completed, will permit analog investigations of the most complicated dynamic systems. The computer is provided with a six-channel recorder for the logging of computation results.

Canadian Comstock Co. Ltd., 206 Laird Dr. N. Toronto 17, Ont. HU. 1-3461. C. C. Rathgeb, president.

Subsidiaries: Comstock Shipbuilding Ltd., St. Catharines, Steel Products Ltd., National Electrical Contracting Co. Ltd. Associate company: Comstock Midwestern Ltd.

Products: Power supplies and electrical control equipment including generator controls, control panels, indicators, switchboards, generator control switchgear and power transfer switching units.

Facilities: Manufacturing plant at St. Catharines, Ont. has an area of 40,000 sq ft. Employees number 120.

Canadian Electric Resistors Ltd., 18 Curity Ave., Toronto 16, Ont. PL. 5-1891. K. J. Beeby, general manager.

Affiliate: New company to be formed in the near future to be known as Cerl-Dale Ltd., which will also act as Canadian licensee for Dale Products, Inc., Columbus, Neb.

Products: Wire wound power resistors to specification MIL-R-26, precision resistors, power rheostats, and custom-made vitreous enamel coated wire wound resistors to customer's specifications. Can supply resistors meeting the following specifications: MIL-R-26C, MIL-R-18546B(Ships), MIL-R-93B and MIL-R-10509C.

Facilities: One-story brick and block building, 4,500 sq ft. Patrolled by local police during off-shift periods. Fully equipped with standard and precision resistor winding machines, welders, vitreous enamelling furnace and supporting assembly devices for resistors. Quality control procedures include incoming materials inspection, patrol inspection on production line and final inspection and test of completed products. Personnel include the general manager (also chief engineer), office personnel, quality control supervisor and 15 skilled plant operators on resistor production.

Canadian General Electric Co. Ltd., 214 King St. W., Toronto, Ont.

Parent: General Electric Co., New York.

General: The Electronic Equipment and Tube Department is divided into two components: electronic equipment; tubes and devices This department has 3 plants with a total manufacturing floor space of 500,000 sq ft, and employs 2,000 persons, including an engineering staff of 150. CGE as a whole operates 15 plants with a total area of 5,000,000 sq ft, and employs 14,000 people, including 700 registered professional engineers.

Electronic equipment: Canadian General Electric Co. Ltd., Electronic Equipment and Tube Department, 830 Lansdowne Ave., Toronto 4, Ont. LE. 4-6511. I. A. Mayson, marketing manager.

Products: Development, design and production of a wide range of electronic equipment, including heavy ground radar, servo amplifiers, advanced transmission systems, complex accessories for primary radars, airborne detectors, ssb scatter systems, transistorized contamination meters; television and radio transmitting and studio equipment, mobile radio and other communication equipment.

Capable of producing airborne fire control radar; countermeasures and submarine detection equipment; data link, missile guidance and detection systems; gun sights and fire control computers; search and height finding radar; data processing and display.

Facilities: Include coil winding, potting, metal finishing, painting, automatic wire cutting, stripping and tinning. Inspection and test equipment includes a primary frequency standard, magnetron tester, drop-test machine, altitude and climate chambers, vibration table. Security measures have been approved by DDP.

R & D: Sophisticated development projects have been undertaken for General Electric Co. for end-products used in U.S. Air Force, Navy and Army systems. Representative of this activity are advanced radar and data processing systems; also a single sideband amplifier for a USAF tropospheric scatter system, and complex accessories for primary radars.

Airborne radar: the APG-501 (further improvement of the APG-30) was developed for altitude capability, pressurization and extended range; approximately 2,000 airborne radar units have been manufactured for the RCAF, USAF and NATO. Search and height-finding radar: a number of improvements and retrofits have been developed to improve initial operational concepts, and systems have been built for the RCAF and USAF. An airborne detector for the RCN using transistor circuitry, and a lightweight, easily portable instrument to indicate the presence of beta and gamma radiation for the Canadian Army represent other important developments.

Communication equipment: development of microwave and multiplex equipment includes a system using time division multiplex, providing message and teletype facilities for the RCAF; a microwave development for the USAF carrying message circuits in frequency division multiplex; a 40 kw hf transmitter designed to operate with automatic tuning to any of six selected frequencies within the assigned range. Radio broadcast transmitters have been designed and produced since 1950; and a television broadcast transmitter program, utilizing the modular concept, has produced basic units handling requirements of any power. A 1 kw am Civil Defense Station, complete with a 150-foot antenna, has been designed and built in prototype quantity to meet the need for a transportable, self-contained broadcasting station.

Tubes and devices: Canadian General Electric Co. Ltd., Electronic Tube Section (Radio Valve Co. Ltd.), 189 Dufferin St., Toronto 3, Ont. LE. 4-6311. R. Story, vice-president and general manager. Second plant located at 1 Radio Valve Rd., Rexdale, Ont.

Products: Electronic tubes, including receiving and cathode ray types, in both commercial and military versions; also semiconductor devices. Military approval has been obtained for 56 different tubes and semiconductor devices. Power tubes, transistors and plug-in modules have been supplied for military equipments.

Facilities: Full equipment to meet present nominal yearly capacity of 500,000 crt's, 12 million receiving tubes and 1 million semiconductor devices. Inspection procedures and equipment capable of satisfying the most stringent military quality control requirements. Security arrangements approved by DDP.

R & D: Research and development successfully undertaken on both tubes and semiconductors. Fully staffed and equipped for this type of work, with a highly experienced group of design, development and application engineers.

Canadian Line Materials Ltd., 3595 St. Clair Ave. E., Toronto 13, Ont. AM. 1-7111. J. West, product manager.

Affiliate: McGraw-Edison Co. (Canada) Ltd.

Products: High current density selenium rectifier stacks, dc power supplies, battery chargers, tape relay cabinets for teleprinter systems, type winders, carrier current off-peak water heater controls, 2-way amplifier equipment, airport lighting controls, telephone relays. The company has also manufactured gasoline engine generator sets.

Facilities: Steel-frame, asbestos-siding building of 137,000 sq ft, protected by full time watchman and time lock devices. Full manufacturing facilities including selenium coater, coil winding equipment, sheet metal working equipment, etc. Test laboratory is fully equipped to handle inspection of the products listed.

R & D: Engineering department is staffed and equipped for development of products in the areas mentioned. Key engineers include S. Gramlewicz and A. Hase.

Canadian Marconi Company, 2442 Trenton Ave., Montreal 16, Que. RE. 8-9441. S. M. Finlayson, president and general manager.

Products: Airborne—doppler navigators, radio compasses; Marine—direction finders, radio telephones including portable lifeboat and pleasurecraft sets, radar (with and without true motion), ship's intercom, loudhailers, automatic pilots and electronic ship's logs, trawler cable meters, depth sounders, fish finders; Fixed radar systems; Industrial and educational television systems; Broadcast and television station equipment; Communications—mobile and other radio telephones, ssb and other types of radio relay systems (DQ58 multichannel relay equipment has been chosen for Canada's air defense communications system), medium- and low-power hf transmitters, selective calling apparatus, central station equipment; System planning, installation and maintenance; Tubes—microwave types, including magnetrons and klystrons, receiving types, cathode ray picture tubes; Components; Instruments.

Facilities: 270,000 sq ft of manufacturing and engineering laboratory space, 175,000 sq ft of warehousing space. Complete equipment for manufacture and assembly of wide range of electronic products, including machine shops, tool room, sheet metal, welding, etc. Modern test equipment for quality control, manned by skilled engineers and technicians. Plants are fully fenced and protected by 24-hour security guard patrol—approved by DDP. Total of 2,400 employees, including 35 management, 200 professional engineers, 1,000 skilled technicians, remainder unskilled or office workers.

Canadian Stackpole Ltd., 550 Evans Ave., Toronto 14, Ont. CL. 5-2373. D. Knapp, vice-president and general manager.

Affiliate: Stackpole Carbon Co., St. Mary's, Pa.

Products: Fixed composition resistors for military and commercial applications.

Facilities: One story brick building, 25,000 sq ft, fully sprinklered and protected by Dominion Electric. Key personnel have security clearance. Facilities include molding and high speed painting equipment, and statistical quality control methods are applied. Employees include 40 unskilled, 10 skilled, 5 management and 5 clerical.

Canadian Westinghouse Co. Ltd., Electronics Division, Longwood Rd. S., Box 510, Hamilton, Ont. JA. 8-8811. F. R. Aitken, manager marketing services.

Affiliates: Westinghouse Electric Corp. and Westinghouse Air Brake Corp. Subsidiaries: Canadian Westinghouse International Co. and B. F. Sturtevant Co. of Canada Ltd.

Products: Design and manufacture of integrated electronic systems including communications, sonar, radar, fire control, torpedoes, missile fuzing and guidance. Present products include guided missile electronics, microwave line-of-sight and tropospheric scatter communications equipments, homing torpedoes, naval armament systems, radar systems (ground, shipborne, airborne), electronic counter-measures equipment, industrial control electronics and data handling equipments. Analog computation and environmental laboratory services are available to other organizations.

Facilities: One four-story brick building providing 225,000 sq ft of manufacturing floor space,

including machine shop, paint shop, fabrication areas, assembly and test areas, and analog computer. A separate brick building of 10,000 sq ft houses the Environmental and Appraisal Laboratory. For several years the security system at the Electronics Division has been geared to the production of military products through a system of security guards and restricted areas; the plant is cleared by DDP to handle programs up to the Secret classification.

The complete and varied manufacturing facilities of Canadian Westinghouse Co. Ltd. are available for the manufacture of defense products. These include an extensive R & D laboratory, precision machine shops, foundry, and assembly areas. They cover an area of 2,270,000 sq ft in the Hamilton district. In addition to the analysis of defects, the Electronics Division Quality Control Dept. operates skilled incoming, line and final inspection and test departments. The Q.C. system can easily be adapted to meet MIL-Q-5923C, and has many years of experience in performing tests and inspection on behalf of DND. Approximately 750 people are presently employed by the Division; of these, about 400 are in the Engineering Dept., including over 200 graduate engineers.

R & D: The Division is well-qualified to carry out R & D projects. Relevant facilities include a PACE general purpose analog computer, the environmental and appraisal laboratory, an antenna range, and the 5,000 sq ft model shop.

Canadian Westinghouse Co. Ltd., Electronic Tube Division, Longwood Rd. S., Box 510, Hamilton, Ont. JA. 8-8811. L. A. McCalpin, manager. Second plant at Grimsby, Ont.

Products: Complete line of receiver, power, special purpose and cathode ray tubes, including reliable and ruggedized versions. Many types have approvals to JAN-1A.

Facilities: Four brick and steel buildings, total 160,000 sq ft, fenced, with security guard patrols —cleared by DDP. Complete tube making facilities, including machine shop, equipment design section, etc. Quality control section has its own superintendent and complete facilities. The integrated division setup, including management, marketing, engineering and manufacturing, has some 500 salaried and production employees.

R & D: All facilities of the company, including the Electronics Division (see above), are available for the support of R & D projects on tubes and applications.

Cannon Electric Canada Ltd., 160 Bartley Dr., Toronto 16, Ont. PL. 7-2845. W. A. Bradley, general manager.

Parent: Cannon Electric Co., Los Angeles 31, Calif.

Products: Multi-contact, coaxial, guided missile, microphone, modular, power, printed-circuit, rack-and-panel, miniature, thermocouple and waterproof electrical connectors. Also solenoids, relays and harnessed connector assemblies and related components.

Facilities: New one-story 20,000 sq ft building of steel, reinforced concrete and brick construction. Fully sprinklered with round-the-clock watchman service. Machine shop equipment includes turret lathes, automatic screw machines and all necessary second operation machines; die-casting machines and plating department; assembly department. Complete quality control department including inspection at all levels; inspection and testing equipment includes megohm bridge, millivolt-amp test equipment, dc and ac power supplies, temperature cycling equipment and plating thickness tester. Plant security measures are available if required and several key employees have military security clearance. Employees total 100.

R & D: Capable of developing new types of connectors, plugs and receptacles. Key personnel include Thomas Hayes, chief engineer and John Blanchenot, plant engineer.

Capacitors of Canada Ltd., 38 Upton Rd., Scarborough, Ont. PL. 5-2218. L. Verdone, president.

Products: Non-inductively wound paper and mylar capacitors, mineral oil impregnated, assembled in black phenolic cases and epoxy end-sealed. It is also planned to produce metallized mylar capacitors.

Facilities: One story masonry building, 3,000 sq ft, protected by sprinkler system, direct line to local fire-hall and company watchman patrol. Plant has a capacity of 30,000 units per day, with equipment comprising machine tools, molding presses, impregnating plant and five Kroessler winding machines in a temperature and humidity controlled area. Quality control procedures include incoming inspection of raw materials, roving inspection, spot-checks at each operation, 100% finished product testing, and daily laboratory checks on production. Personnel include 2 management, 3 skilled technical, and 10 production workers.

Carriere & MacFeeters Ltd., 936 Warden Ave., Scarborough, Ont. (Sales & Service Division) & 82 Northline Rd., Toronto 16, Ont. (Manufacturing Division). PL. 7-5103. Wm. Dunlop, sales & service manager.

Products: Electro-mechanical components, including sub-miniature hermetically sealed relays and high-temperature solenoids. Also have extensive repair and overhaul facilities for aircraft electrical and similar equipment.

Facilities: Two modern buildings of brick and steel construction:—Warden Ave. plant—23,000 sq ft; Northline Rd. plant—10,000 sq ft. General machine shop equipment including lathes, drill presses, etc., and bench equipment such as spot-welders, coil winding equipment and punch presses. Adequate inspection staff provides for 100% inspection; resident DND Inspection Services representative carries out statistical inspection on military components.. Personnel totals 75, including supervisory, engineering and inspection staff.

R & D: Presently engaged in Defense Research Board contract relating to a study of general purpose relays for use in tri-service applications. Interested in further contracts in this general area.

Centralab Canada Ltd., Ajax, Ont. Sales: 669 Bayview Ave., Toronto 17, Ont. HU. 1-2291. P. J. Heenan, sales manager.

Parent: Centralab Division, Globe-Union, Inc., Milwaukee 1, Wisc.

Products: Ceramic capacitors and rotary switches. Approvals to MIL-C-20 have been obtained for certain items.

Facilities: one-story steel and brick building, 31,000 sq ft, with all necessary production machinery. All products receive 100% final inspection with quality control checks on a statistical basis during manufacture. Final test area is temperature and humidity controlled. Employees total 50, of whom about 40 are production workers.

R & D: Access to services of research and development laboratories of parent company.

C. P. Clare Canada Ltd., 2700 Jane St., Box 73, Weston, Ont. ME. 3-6793. G. D. Zimmerman, president.

Parent: C. P. Clare & Co., Chicago, Ill.

Products: All forms of telephone type relays, also miniature and sub-miniature types for the electronic industry.

Facilities: Plant area 2,000 sq ft, total employees 6.

Collins Radio Co. of Canada Ltd., 11 Bermondsey Rd., Toronto 16, Ont. PL. 7-1101. A. I. O. Davies, director of sales. Also at 195 Bartley Dr., Toronto 16, Ont. and 77 Metcalfe St., Ottawa 4, Ont.

Parent: Collins Radio Co., Cedar Rapids, Iowa, which also has major facilities at Dallas, Tex., and Burbank, Calif. Collins Radio Co. of England Ltd. and Communications Accessories Co., Missouri, are wholly owned subsidiaries of the parent company.

Products: Collins Canada has an efficient facility for the development and production of precision electro-mechanical communications equipment from small avionic transceivers to large ground transmitters.

Present products include 1,750 channel 20 watt uhf airborne transceiver for RCAF (AN/ARC-552); 35,000 channel 100 watt hf airborne transceiver for RCAF (AN/ARC-38); 20 channel 100 watt hf airborne transceiver for RCN (18S-4B); uhf- antenna tandem filter for RCAF (156-2B); 1 kw uhf ground transportable scatter terminal (TST-101); and a range of commercial ground transmitters and receivers for export by the parent company. Previous military products include all tropospheric scatter communications equipment for the DEW Line under sub-contract from Western Electric Co.; 1750 channel uhf airborne transceiver for RCN (AN/ARC-27); uhf antenna for RCAF (AS-505B); uhf direction finder for RCAF and RCN (AN/ARA-25).

Facilities: 50,000 sq ft in two one-story brick construction buildings. Fabrication department takes care of nearly all sheet metal and machining requirements; includes 40 and 100 ton presses, three lathes, three milling machines, five drill presses, four riveters, three coil winders, etc., and facilities for silver soldering, chromite dipping, de-greasing, tumbling and silk screening. All departments participate in quality control, which was originally developed to include the requirements of specification MIL-Q-5923. Further developments have resulted in the company conforming to the requirements of IS(T) 101A, PROC 101-1 and MIL-Q-5923B. DND Inspection Services have a resident representative in the plant.

Both plants are equipped with fire alarm systems and the main production building has a sprinkler installation. Plant security measures have been approved by the industrial security branch of DDP. Personnel include 30 management, 7 engineers, 35 technicians, 42 skilled, 56 semi-skilled and 70 clerical. A training program has been established for new employees; existing employees are encouraged to participate in advanced training programs leading to work involving greater responsibility.

R & D: A well equipped laboratory is undertaking R & D projects and includes test equipment for developing lf through to uhf end-products. Other groups are investigating components for use in end-products, full environmental test equipment being available locally as and when required. Key engineers include J. P. Giacoletto, F. W. Preziosi and D. E. Gerrior.

Computing Devices of Canada Ltd., Bell's Corners, Box 508, Ottawa, Ont. TA. 8-2711. W. S. Kendall, marketing director.

Affiliate: Bendix Aviation Corp., Detroit, Mich.

Products: Development and manufacture of special purpose electronic and electro-mechanical equipment, airborne analog and digital computers, nuclear test equipment and instrumentation. Present products include the Type W410 Kicksorter, an advanced 100-channel transistorized pulse height analyser featuring magnetic core storage; PHI position and homing indicator, an automatic dead reckoning navigation system for single seater fighter aircraft, of which the Mk. 4 version has been adopted by the West German Air Force; Skyline doppler navigation computer for commercial and other transport aircraft.

Facilities: 157,000 sq ft in two one-story modern brick and steel buildings on an 88-acre site. Manufacturing facilities occupy a separate 75,000 sq ft building, in addition to 3,000 sq ft White Room for electro-mechanical assembly and wiring in the Engineering Building. Equipment includes a machine shop with more than $250,000 worth of precision machine tools, plating shop, paint shop, and assembly areas designed for the efficient production of small and medium sized runs of electronic equipment. Machine tools and equipment are such that working and finishing of all kinds of material to high precision standards is routine. Assembly of instruments is done in a dust-free, constant temperature and humidity environment. Recently-added facilities for the quantity production of radiation dosimeters include the dust-free White Room and a concrete shielded radiac chamber for testing and calibration.

Security systems, including guards, patrols and floodlighting have been approved by DDP, the company having been continuously engaged in classified defense contracts. With the increasing emphasis on manufacturing in the company, a Quality Control Branch has been set up, with direct responsibility to the president. QC personnel number 42, including a manager, chief inspector and two deputy chief inspectors (one mechanical, the other electrical and electronic). Quality engineering staff includes specialists in mechanical, electrical, electronic and microwave problems, supported by a wide range of precision measuring equipment. Total employees are 650, including the following technical personnel: management and supervisory—24; non-supervisory engineers and other professionals—62; technologists and technicians, computing assistants and draftsmen—254.

R & D: Experienced team of highly qualified development engineers and scientists have continuous access to a REAC 95 analog computer and a Bendix G-15D digital computer with differential analyser attachment, and a wide range of other laboratory equipment.

The Consolidated Mining & Smelting Co. of Canada Ltd., 215 St. James St. W., Montreal 1, Que. AV. 8-3103. A. O. Wolff, manager, metal sales. Mailing address: Box 1030, Place d'Armes, Montreal 1, Que. Refining plants: Trail, B.C.

Products: Electronic semiconductor and thermocouple materials—the following metals in various high-purity grades up to 99.9999% pure: indium, lead, zinc, bismuth, cadmium, silver, tin, antimony. Supplied in ingot and fabricated forms, e.g., indium preforms, etc. Intermetallic compounds are also produced.

Canadian resources

Facilities: Extensive fenced and guarded plants include complete shop facilities in all trades, with inspection and test arrangements appropriate to the products listed. Security measures of specified areas are approved by Canadian and U. S. Governments. Personnel total 7,100, with a technical staff of 500, and 50 research scientists.

R & D: Extensive research laboratories and equipment; central laboratories and library at Trail, B.C. have branches in all divisions. Labs. are equipped with the most modern facilities for analytical physical measurement and control. A new high-purity metals operation, specializing in materials for the electronics industry, is currently entering production. Manager of research and development is A. D. Turnbull.

The Constanta Co. of Canada Ltd., 280 Regina Ave., Verdun, Montreal 19, Que. PO. 8-3235. R. P. Aldred, manager.

Products: High stability deposited carbon precision resistors. Standard, hermetically sealed, and molded types for a wide range of power ratings and resistance values. CAMESA approvals have been obtained for 1- and 2-watt types, and resistors are currently being supplied to the USN.

Facilities: Reinforced concrete building, 10,000 sq ft, with all equipment necessary for manufacture and test of this type of resistor. Every unit goes through two checking phases during production; inspection department carries out spot-checks at these stages and 100% final test using reflector galvanometer in a temperature-controlled room. DND inspectors attend the plant as required. Total employees number 20, including 13 production and 2 inspection.

R & D: All products have been developed, designed and manufactured in Canada. Company is interested in developing resistors using stabilized deposited carbon films, and has adequate engineering ability, electrical and environmental test laboratory facilities for this purpose.

Continental-Diamond Fibre of Canada Ltd., 46 Hollinger Rd., Toronto 16, Ont. PL. 5-5211. A. G. Ballard, president.

Parent: Continental - Diamond Fibre Corp,. Newark, Del. (subsidiary of The Budd Co., Philadelphia, Pa.) Affiliates: Howard Smith Paper Mills Ltd., Arborite Div., Canada, and Tatnall Measuring & Nuclear Systems Ltd., Toronto, Ont.

Products: Specializing in the fabrication of laminates and vulcanized fibre for defense industries. Laminates include copper-clad for printed circuits, phenol, melamine, epoxy and silicone types. Have supplied large quantities of fabricated parts as a sub-contractor during World War II, the Korean War and since.

Facilities: One-story modern building, 40,000 sq ft, with complete equipment for fabrication, and maintenance of a high level of inspection. Employees number 70, including qualified management and engineering personnel.

In addition to the above facilities the company offers physical testing machines, stress analysis, non-destructive test equipment, nuclear radiography and electronic systems through its subsidiary company: Tatnall Measuring & Nuclear Systems Ltd., at the same address.

R & D: Parent and affiliate companies all maintain important research facilities.

Croven Ltd., 628 Kent St., Box 1420, Whitby, Ont. MO. 8-3325 and Toronto EM. 6-6012. Paul A. MacPhee, vice-president sales.

U. S. Subsidiary: Ovenaire Inc., Charlottesville, Va.

Products: Present products include quartz crystals and crystal ovens. Company is also capable of producing crystal filters and packaged oscillators.

Facilities: Two cement block and brick buildings, total 9,000 sq ft, with automatic sprinkler system and alarm to local fire department. Modern production and test equipment is used in a continuous-flow type of operation, with inspection and quality control department adjacent to assembly areas. Resident government inspector is on premises at all times; full source inspection facilities with quality control at each stage and final assembly points. Personnel total 75, including 5 administration, 3 management, 4 engineering, 63 skilled and semi-skilled production. Weekly lectures are given to supervisory and other key personnel on methods, design, quality control and general efficiency. All operating personnel are qualified to use test facilities.

R & D: Research and development on both crystals and crystal ovens is on a continual basis, employing complete environmental test facilities which duplicate actual operating conditions. The development of special components to customer specifications is performed by the engineering dept.

Cushing & Nevell Ltd., 181 Eglinton Ave. E., Toronto 12, Ont. HU. 7-2866. J. Webb Maynard, general manager. Branch Office: 237 Queen St., Ottawa 4, Ont.

Parent: Cushing & Nevell, New York 17, N.Y.

Products: Engineering services for technical illustration and writing of instruction books, catalogues, handbooks, and training aids. Draft texts and illustrations are reviewed by qualified writers and artists prior to submittal for approval.

Facilities: Adequate office area available, locked files and cabinets for storage of drawings, reports, manuscripts and artwork meet DDP requirements and have been approved. Total personnel of 15 includes 4 engineering writers and 6 technicians.

Daly Capacitors Ltd., 140 Kendal Ave., Toronto 4, Ont. WA. 4-8327. F. S. Dunkl, vice-president & production manager.

Parent: Daily (Condensers) Ltd., London, Eng.

Products: Electrolytic capacitors.

Facilities: 7,000 sq ft, of which half is devoted to production. Winding and forming machines, presses, kilns, and supporting equipment. Personnel include 3 administrative, 1 engineering, 1 inspection and 20 production workers.

J. H. Darcy Ltd., 51 Abbott St. N., Smiths Falls, Ont. 228. H. R. Sawyer, office manager.

Affiliate: Canadian Line Materials Ltd., Toronto, Ont. (sales agents for relays only).

Products: Relays — telephone type, miniature, electro-mechanical latching and industrial types. Special test and control equipment.

Facilities: One-story cement block building, 4,800 sq ft, equipped to manufacture parts and small cases for relays. Complete assembly and test facilities for relays and other products. Employees total 19, including 2 technical/administrative, 1 engineer, 2 toolmakers, 2 coil-winders, 5 assemblymen, 5 wiremen, 2 adjusters.

Daystrom Ltd., 840 Caledonia Rd., Toronto 19, Ont. RU. 7-1114. H. W. Cowan, vice-president and general manager.

Parent: Daystrom Inc., Murray Hill, N.J. Daystrom Ltd. acts as Canadian branch of Daystrom Inc., and all Daystrom divisions.

Products: Manufacture is only on a small scale at present, mostly concerned with Weston products, but is planned eventually to embrace the complete Daystrom line, including electronic controllers and recorders, pressure recorders, circuit analysers, thermometers, exposure meters, servo amplifiers, memory systems, oscilloscopes, tuners, signal generators, tube checkers, hi-fi audio equipment, speaker systems, communication transmitters and receivers, nuclear instrumentation, servomotors, servomechanisms, gyros, potentiometers, instruments for aircraft and guided missiles, power supply instruments, flight computer devices.

Facilities: Split-level building, including 7,500 sq ft for manufacturing and warehouse, and 2,500 for office. Equipped with machine tools and other specialized equipment for the assembly of instruments. Wide range of electrical and electronic test equipment, with calibration accuracy of 0.05%. Present staff comprises 4 management, 5 skilled technicians, 4 shippers, and 33 office personnel. Training facilities are available from affiliate companies.

R & D: Key personnel could be transferred from U. S. affiliates to launch any R & D project that falls within the company's capabilities.

Decca Radar (Canada) Ltd., 23 Six Points Rd., Toronto 18, Ont. BE. 2-1161. L. J. Dennett, general manager.

Parent: Decca Radar Ltd., London, England. Affiliate: Decca Navigator Co. Ltd., London, England.

Products: Teletype and facsimile equipment; radar equipment; meteorological instruments and apparatus.

Facilities: Available plant area is 150,000 sq ft, present employment being 80.

W. E. Dillon Co. Ltd., Copeland St., Toronto 17, Ont. HU. 8-1167. E. M. Dillon, president.

Products: High class sheet steel enclosures, consoles, panels, chassis, etc.

Facilities: Total plant area, 65,000 sq ft; 150 employees.

E.M.I.-Cossor Electronics Ltd., Woodside, Halifax County, N.S. Halifax 6-7491. A. C. Carter, exec. vice-president and general manager.

Parents: E.M.I. Ltd., Hayes, England; A. C. Cossor Ltd., London, England.

Products: Sonar equipment, sonobuoys, special communications equipment, battle and sonar simulators, microwave antennas, loudhailers, instruments, oscilloscopes, test equipment, hydrophones, deflection coils and systems, centimetric products, audio and video community equipment. Have supplied IFF equipment, sonar, sonobuoys, vhf communications and countermeasures equipment to RCAF and RCN.

Facilities: 56,000 sq ft new building of steel, brick, aluminum siding and curtain wall (opened in 1959). Whole building has filtered air intakes, one-third being completely air-conditioned. Complete machine shop, sheet metal, plating, painting, and welding equipment (including argon arc). Full range of test equipment includes an underwater anechoic tank, quality control procedures being fully approved to IS-T-101. Resident inspectors from DND, RCN and RCAF. Personnel total 335; engineering dept. numbers 90, including 25 professional engineers; test and inspection has 21 employees.

R & D: Have developed and designed all own products. Interested in projects related to test installations, sonar, sonobuoys, ionospheric research, countermeasures, display systems.

Edo (Canada) Ltd., East Front St., Box 97, Cornwall, Ont. WE. 2-6774-5. Ralph R. Hind, vice-president and general manager.

Parent: Edo Corp., College Point 56, N.Y. Electro-Ceramics Inc., Salt Lake City, Utah, is a subsidiary of Edo Corp.

Products: All types of sonar and underwater acoustics, including associated electronics, airborne loran and other navigational aids; specialized transducers for naval ship-fitted sonars; commercial echo sounders and survey depth sounders.

Facilities: One-story steel frame and brick building, 20,000 sq ft. 16,000 sq ft manufacturing area, 4,000 sq ft office area, completely air-conditioned, humidity-controlled transducer room for crystal assembly. A new underwater test facility has just been completed in the St. Lawrence River, adjacent to the company's property, which includes 1,000 sq ft in the test establishment. Complete facilities for electronic assembly work, including small machine shop for plant maintenance and model work. Quality control is responsible directly to management, with check points during manufacture and final inspection of all products. Security guard system is being established in near future; however, plant security is now approved by DDP. Total personnel of 40 includes 5 engineers, 4 technicians.

R & D: The new underwater test establishment with elaborate instrumentation is capable of doing all underwater studies for sonar transducers, torpedo transducers, hydrophones, and sonar domes. Mr. R. Lapetina, who heads this facility, has had 11 years specializing in the research and design of sonar equipment and associated electronics.

Edwards High Vacuum (Canada) Ltd., Cumberland Ave., Box 515, Burlington, Ont. NE. 4-7757 and Toronto EM. 3-9841. R. G. Webster, manager.

Affiliates: Edwards High Vacuum Ltd., Manor Royal, Crawley, England; Edwards High Vacuum Inc., Niagara Falls, N.Y.

Products: High vacuum rotary and vapor diffusion pumps, vacuum furnaces, vacuum evaporating units, all-metal bakeable valves, ultra-high vacuum systems, vacuum instruments and measuring equipment, pressure-sensing devices, safety switches.

Facilities: One-story brick and metal-clad building, 2,000 sq ft, with complete leak and other test facilities, lathes, drill presses and other metal working machines. Personnel can act as technical advisors for high vacuum equipment, and special units are manufactured to customers' requirements.

Electric Products Co. Ltd., 9720 Waverly St., Montreal 12, Que. DU. 9-8267. J. T. Auer, manager.

Products: Rectifiers, power supplies, battery chargers, filters, saturable reactors, transformers up to 50 kva.

Facilities: Plant area 10,000 sq ft; 50 employees.

Electronic Associates Ltd. Technical Publication Division, 105 Willowdale Ave., Willowdale, Ont. BA 1-7961. G. F. Eaton, general manager.

Products: Technical writing, drafting, illustrating and cataloguing. Extensive work on manuals, engineering orders, etc., has been done for RCAF, RCN and other government branches.

Facilities: Adequate office space for the writing and illustration of manuals for complex equipments, including some reproduction facilities. Present employees number 15.

Electronic Communications Ltd., 370 Beauharnois St., Montreal 11, Que. DU. 1-2385. G. Kinsey, president.

Products: Automatic telephone systems, remote control equipment, various types of communications equipment.

Facilities: One-story steel frame and brick building, 4,000 sq ft. Basic machine shop and spray painting equipment.

Electronic Materiels International Ltd., 342 Gladstone Ave., Ottawa, Ont. CE. 6-7148. P. E. Mahoney, president and general manager.

Products: Ground and airborne telecommunications equipment.

Facilities: Plant area 20,000 sq ft; total employees, 150.

Electronic Research & Development Co. Ltd., 210-9th Ave. S.E., Calgary, Alta. AM. 6-6048. L. S. Libin, managing director.

Affiliate: Electronic Service Supply Co. Ltd., same address.

Products: Du Mont vhf and uhf land-mobile radio line manufactured under license; also mf and hf fixed station transmitters up to 1 kw. Audio pre-amplifiers, power amplifiers, consoles. Carrier telemetry systems. Power supplies. Control panels.

Facilities: 2-story brick building of 30,000 sq ft at Calgary; 10,000 sq ft concrete and frame building at Regina, Sask. Metal working equipment with press capacities up to 20 tons, brakes, notchers, etc. Cadmium and silver plating equipment. Laboratory is well-equipped with signal generators, oscilloscopes, etc.; in-process quality control setup is on a step-by-step basis. Design and quality control engineers have long experience with vhf and uhf radio, and radio operated telemetering systems. Personnel includes 5 engineering, 2 quality control, 4 machine shop, and 40 production workers.

W. R. Elliott Ltd., 134 Sydney St. South, Box 531, Kitchener, Ont. SH. 3-6351. Wm. R. Elliott, president and general manager.

Products: Electro-mechanical assemblies, elevating and training gear, fabricated weldments and pressed parts and assemblies for electronic equipment.

Facilities: One brick and concrete building total area just under 20,000 sq ft, with 1,500 sq ft devoted to manufacturing. Comprehensive machine shop equipment, including lathes, boring machines, milling machines and drill presses. Also complete sheet metal and welding equipment. Inspection department is adequately equipped for checking precision and other parts. Employees total 45, including four engineering and three inspection.

El-Met-Parts Ltd., Head St., Dundas, Ont. MA. 8-6366. R. A. Briggs, P.Eng., sales manager.

Products: Silicon steel and nickel alloy laminations, wound cores, magnetic shielding, hydrogen annealing. Interested in manufacturing toroidal and powdered cores.

Facilities: One-story concrete block building, with 13,000 sq ft manufacturing area. Tool room (production of tools and dies), press shop (maximum 60 tons hydraulic), complete magnetics testing laboratory. Magnetic testing is performed as outlined by ASTM (Committee A-6), also special magnetic circuit inspection. Personnel total 33, including 5 management, 5 technical, 8 skilled toolmakers, 15 unskilled.

Engineered Sound Systems Ltd., 169 Kipling Ave. S., Toronto 18, Ont. BE. 3-2155. J. R. Bain, manager.

Products: Audio equipment, including industrial and institutional sound systems, audio amplifiers, dc power supplies, switching and monitor panels. Also act as sales representatives for tape recorders and intercommunication equipment.

Facilities: 3,000 sq ft concrete block building containing sheet metal working and electronic assembly equipment. Inspection and test dept. is equipped with a wide variety of measuring apparatus, including high-potential test set, and wow and flutter measuring set. Staff totals 15, including professional engineers; chief engineer has been actively engaged in the audio and acoustical field for over 20 years.

Erie Resistor of Canada Ltd., 7 Fraser Ave., Trenton, Ont. EX. 2-6524 and Toronto EM. 2-3315. Geo. F. Kempf, vice-president and general manager.

Parent: Erie Resistor Corp., Erie, Pa. Affiliate: Erie Resistor Ltd., Gt. Yarmouth, England.

Products: Capacitors—ceramic disc, tubular, button silvered mica, ceramic and plastic trimmers, special feed-thru and stand-off types. Also filter assemblies.

Facilities: One modern brick and block building, total 21,000 sq ft. Complete production machinery of modern design, with small supporting machine shop. Quality control dept. has well-equipped laboratory, and operates a McBee card system in accordance with MIL Std. 105A. Total employees 35.

R & D: Engineering and technical personnel have developed a low band pass filter assembly, and a glass-seal button mica capacitor under a Defence Research Board contract. Laboratory has environmental and other test equipment for evaluating the characteristics of new capacitor developments.

Ferranti-Packard Electric Ltd., Electronics Div., Industry St., Toronto 15, Ont. RO. 2-3661. G. W. L. Davis, manager, technical services group.

Parent: Ferranti Limited, Hollinwood, England. Associate: Ferranti Electric Co,. New York, N.Y.

Products: Present products include high speed paper tape readers (400 characters per second with start or stop on one character); magnetic storage drums; air bearings; air servo head columns; UHF long range, low power meteor scatter communication systems with automatic error correction and capable of 1,200 words per minute; fully transistorized special and general purpose computers; electric gyros; flight systems; fire control systems. The company has produced DATAR (data transmission, storage and display system); electric fuses; TASC (computer for the University of Illinois). Capable of producing data handling and display equipment, input-output devices, communication equipment, nuclear reactor control equipment, gyros, and data systems.

Facilities: Masonry and steel building with a gross area of 230,000 sq ft including 12,000 sq ft of environmentally-controlled assembly area. Apart from standard and turret lathes, facilities include precision and instrument lathes, coil and armature winders, precision drilling and tapping machines, magnetic drum turning machines, automatic hydrogen annealing oven, precision thread grinders, universal grinders, printed circuit processing equipment, baking and drying ovens, protective coating and anodizing equipment. Approved supplier for RCAF and Department of Transport. Components which are used in their products may be source inspected. They have approved provisions for inspection and quality control that have been set up and maintained in connection with defence orders from U. S. corporations and government agencies, as well as European equivalents and the SHAPE organization.

A chain link fence surrounds the plant and guards are on duty at the gates. Plant security measures have been approved by DDP. Personnel include 6 management, 6 research engineers, 18 design engineers, 12 engineering assistants, 60 skilled and 40 unskilled employees.

R & D: A background of research and development in data processing began in 1949 with the DATAR project, followed by reactor control equipment and the installation of a completely transistorized computer for the Canadian Post Office. Facilities will be expanded in September, 1959, with the installation of a Pegasus general purpose computer.

Firestone Tire & Rubber Co. of Canada Ltd., Burlington St. E., Hamilton, Ont. LI. 5-4711. F. Sommers, manager, manufacturers sales.

Products: Radomes, antennas and support tubes. Radomes are produced in both inflatable and rigid types.

Facilities: Total floor space of 846,000 sq ft, including 3,000 for engineering and 4,000 for laboratory. Production machinery includes complete facilities for manufacturing rubber—banbury mixer mills, calenders, extruders, fabric coaters, curers and vulcanizers, also heavy and light machine tools. Testing equipment includes ovens, presses, dead-load testers, pressure test equipment for radomes up to 60 ft diameter, portable pressure test equipment and equipment for testing fabric. Personnel working on radomes have been cleared to Secret.

Fleck Manufacturing Ltd., Tillsonburg, Ont. J. D. Fleck, president.

Products: Power cords and wire harness assemblies, as well as insert molding. A previous contract included the production of wire harnesses for torpedos and gun sights.

Facilities: All operations are carried out in one brick and block building with cement floors. Area is 25,000 sq ft divided into two stories with truck level loading for both floors.

Fleet Manufacturing Ltd., Gilmore Rd., Box 300, Fort Erie, Ont. Fort Erie 1400. P. A. Chamberlain, contracts administrator.

Products: Antennas for microwave and tropospheric scatter systems; fixed radomes.

Facilities: Total plant area is 337,000 sq ft, including 277,000 for manufacturing; employees number 450.

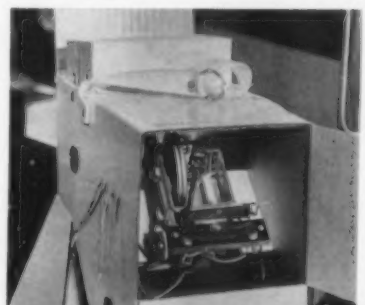
The Garrett Manufacturing Corp. of Canada Ltd., 4 Racine Rd., Rexdale, Ont. CH. 4-5655. A. W. Baker, sales manager.

Parent: The Garrett Corp., Los Angeles, Cal.

Products: Air data systems; air turbine starters; gas turbines, elevation computers; "G" limiters; pneumatic controls; electric temperature controls; magnetic amplifiers; engine performance indicating systems; aircraft engine starter parts; air conditioning and refrigeration equipment; differential pressure and pressure ratio sensors and transducers; wing spoiler systems; accelerometers.

Facilities: One story concrete block and brick building with concrete floors. Total plant area is 11,000 sq ft. The air conditioned laboratory has facility for producing a large volume air flow with a variable range of high and low temperatures for qualification tests. It is equipped with mechanical, pneumatic and electronic measurement instrumentation. Quality control is performed in accordance with Proc. 101-1, Issue 3. The plant layout permits installation of security system with fences, guards, etc. as required. A watchman is maintained at present. Of the total 80 employees, 39 are engaged in direct production and 41 in supporting work. Product engineers average 8 years experience in aircraft and missile equipment fields while the support engineers average 10 years experience in aircraft equipment layout and development shop techniques.

R & D: Research and development resources of the parent company and its various divisions and subsidiaries are at the disposal of the Garrett Mfg. Corp. of Canada Ltd.



High frequency radiosonde—General Instrument—F. W. Sickles of Canada.

Canadian resources

General Instrument - F. W. Sickles of Canada Ltd., 151 Weber St. S., Box 408, Waterloo, Ont. SH. 4-8101. J. McK. McLean, vice-president and general manager.

Parent: General Instrument Corp., Newark, N.J.

Products: High frequency radiosondes for meteorological forecasting purposes; selenium and silicon rectifiers; television tuners; horizontal output and i.f. transformers, rf coils. Supported by the know-how of its U. S. affiliate divisions, the company is capable of producing a wide range of military communications and telemetering equipment, sonar devices, and meteorological equipment. Located in a low-cost area, and with extensive experience in mass production of electronic assemblies.

Facilities: Waterloo—steel frame with brick and masonry building of 70,000 sq ft, constructed to take a second story, and adjacent land would permit a doubling of floor area. Second plant at Mount Forest, Ont. is of concrete block with an area of 7,000 sq ft. Extremely large range of coil winding equipment, complete machine shop facilities for parts fabrication and construction of tools, jigs and fixtures, modern dip-soldering equipment. Major emphasis placed on quality control, commencing with incoming inspection and following through all phases of winding, fabrication and assembly. Manager of Quality Control reports directly to General Manager. Plant is floodlit with controlled access, and is approved by DDP.

A complete schedule for the induction and training of new employees is in operation, and all prospective employees are pre-tested. Engineering team of 25 includes graduates in EE, ME, physics and mathematics, and management staff includes graduates in accounting and economics. Production staff numbers about 500, of which about 75% is female.

R & D: Engineering staff includes senior project engineers with experience in microwave, radar, uhf and vhf, telemetry, meteorological devices, beaconry, and other communications equipment. Director of engineering is E. A. Thomas, formerly chief engineer at Westinghouse; chief engineer is H. O. Tovell, formerly chief engineer at Du Mont. Complete design and test facilities include environmental test equipment for temp./humidity from —100 to +240 deg F/ 20 to 95% R.H., ±5%; and temp./altitude from —100 to +240 deg F/5 millibars within 30 min.

Hammond Manufacturing Co. Ltd., Speedvale Ave. at Edinburgh Rd., Box 37, Guelph, Ont. TA. 2-2960 and Toronto EM. 4-1877. K. W. Hammond, sales manager.

Products: Transformers, reactors, chokes and other iron-core and ferrite-core components, both for commercial application and to specifications MIL-T-27A (Amendment 1), JCNAAF-T-19 and MIL-T-16315 (Naval). There are 618 standard items, and special types manufactured to customers' specifications now include over 50,000 designs. Also high-class sheet metal enclosures, cabinets, racks, panels, chassis, etc. for electrical and electronic equipment.

Facilities: One-story steel and brick building, 90,000 sq ft, on 10½-acre site. Transformer division occupies 50,000 sq ft, with complete facilities including winding, impregnating, assembly, testing and shipping. Sheet metal fabrication division covers about 40,000 sq ft, and has equipment for shearing, sawing, punching, bending, arc and gas welding, baked and air-dried finishes. Complete inspection facilities include resident DND inspectors.

Personnel total 250; salaried staff of 50 includes 8 engineers and 2 laboratory technicians (engineers cleared by DDP); production staff of 200 includes 64 technically skilled, 38 other skilled, balance unskilled. Employees have a 6-month probationary period.

R & D: Engineers have a laboratory with all facilities necessary for the development and design of MIL-T-27A components.

Helipot Division, Beckman Instruments Inc., 3 Six Points Rd., Toronto 18, Ont. BE. 3-1116. P. Simmons, office manager.

Parent: Beckman Instruments Inc., Fullerton, Calif.

Products: Currently supplying single- and multi-turn precision potentiometers to Canadian prime contractors and DDP. Also manufacture miniature high-temperature trim pots., high-temperature rectilinear pots., and precision coil windings.

Facilities: One-story concrete block building of 4,000 sq ft, includes 300 for engineering and laboratory. Production equipment includes specialized coil winding machines for the manufacture of precision windings and resistance elements. Also small machine shop, jigs, fixtures and special tap welding equipment. Test facilities include linearity testers, strip chart recorders, potentiometer noise testers and life-tesing equipment. Employees number 20, key personnel being cleared to secret.

R & D: High-temperature and other types of potentiometers have been developed to the specifications of Canadian military equipment manufacturers. Personnel and equipment are available for further component development.

Honeywell Controls Ltd., Vanderhoof Ave., Leaside, Toronto 17, Ont. HU. 9-2151. J. H. Baldwin, general manager of military products and systems engineering. Second plant at Scarborough, Ont.

Parent: Minneapolis-Honeywell Regulator Co., Minneapolis 5, Minn.

Products: Development, design and manufacture of controls and instrumentation systems for industrial, domestic and military applications. Aircraft instrumentation and flight control systems include panel instruments, airborne computers, gyroscopes and stable platforms, autopilots, electronic and hydraulic servo systems for control surface actuation. This Canadian design-development-production facility can be integrated with those of the entire Honeywell corporation in the wide variety of military and scientific fields for which the company's U. S. associates are noted.

Facilities: 25,000 sq ft at Leaside and 132,000 sq ft at Scarborough are devoted to the production of components and systems, using advanced precision equipment. Complete facilities include design and development laboratories, electrical and mechanical laboratories, a drafting section fully experienced in military standards, a design-production liaison group, and a quality control section for certified stock control and close inspection of manufacturing operations and finished products. 100% testing, including environmental tests, is carried out whenever necessary, and the quality control dept. also obtains regular field reports to ensure adherence to military requirements of products in service.

Personnel total 1,300, those working on gyros and other precision components being located in rooms with precise temperature, humidity, pressure and dust control. Design and development staff includes engineers with training and experience in electronics, servo systems, telemetry, computers, electrical and mechanical engineering and engineering physics.

R & D: Previous development contracts have produced designs for the CF-105 interceptor aircraft, including the Mach indicator, ancillary equipment for the vertical heading and reference platform, and the function selector for the fire control system. Other projects have included the first fully transistorized temperature indicator to go into production, which is employed in Canadair's CL-28 aircraft.

International Business Machines Co. Ltd., Don Mills Rd., Toronto 6, Ont. HI. 4-2511. R. E. Chapman, plant manager (local 223).

Parent: International Business Machines Corp., New York, N.Y.

Products: Present products include electric typewriters, electronic time recording equipment, digital computing equipment, punched card accounting machines, and fuzes for the Dept. of Defence Production. The company has also produced deflection calculators, control training and control tilting devices, and an asdic bearing calculator. Company is capable of producing products in the general area of analog and digital computing equipment, and ammunition or missile fusing and arming devices.

Facilities: Brick and glass block on steel frame building with a gross area in excess of 400,000 sq ft, includes complete manufacturing facilities and supporting departments. Inspection is carried out on incoming materials and components, in-process products and final assemblies; this includes electronic test facilities. Plant has alarm systems on doors and is patrolled by uniformed security guards; security measures have been approved by the Ammunition Branch of DDP. The 1,250 employees include 60 management, 120 technical, 1,020 skilled and 50 unskilled. The company operates a toolmaking apprenticeship training program and provides customer engineering and general educational training facilities.

R & D: The company maintains a close liaison with the IBM Corp. in the United States and receives assistance from them in all operations, and Defense liaison could be readily obtained. This would be of considerable advantage in projects such as SAGE. The engineering department is capable of carrying out stimulation studies using either 650 or 704 computing systems.

International Rectifier of Canada Ltd., 1581 Bank St., Ottawa 1, Ont. RE. 3-6880. E. F. Johnson, secretary-manager.

Parent: International Rectifier Corp., El Segundo, Calif.

Products: Selenium, germanium and silicon diodes and rectifiers; selenium and silicon photoelectric cells. Sales operation only at present, but plan to manufacture in Canada, starting with selenium rectifiers.

Facilities: Office space only at present, other facilities in planning. Present employees comprise only secretary-manager and a stenographer, but company has access to all skills and facilities of parent corporation.

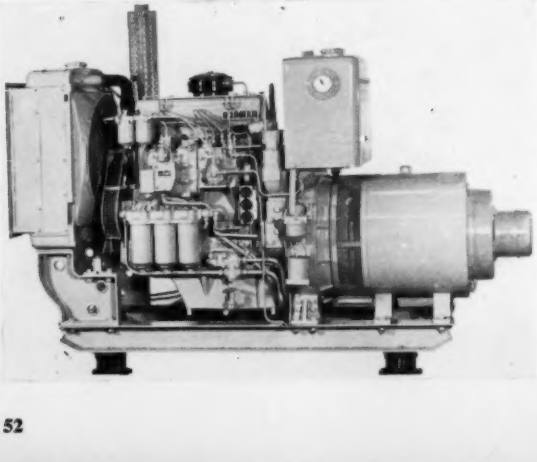
International Resistance Co., 349 Carlaw Ave., Toronto 8, Ont. HO. 1-3511. K. J. Davis, general manager.

Parent: I.R.C. is a Division of Renfrew Electric Co. Ltd., and operates under a licensing agreement with the International Resistance Co., Philadelphia, Pa.

Products: Design and manufacture of composition resistors, volume controls, rheostats, precision film resistors, power wire wound resistors, encapsulated and other precision resistors, special high voltage and high frequency resistors, and other resistance devices for various applications. Approvals have been obtained to various military specifications.

Facilities: Three-story solid cement building of 51,000 sq ft, of which 4,000 sq ft are devoted to engineering and another 2,000 sq ft. to laboratory space. Plant is fully equipped for the manufacture of the products listed above, together with supporting machine shop equipment. The quality control and inspection departments have all gauges and test instruments necessary to check the chemical, electrical and mechanical characteristics of the products. Equipment is maintained to complete all tests required under military specifications for resistors, and includes load-life equipment, hot and cold chambers, humidity chambers, high temperature furnace, high voltage test equipment, vibration tables, etc. Personnel total just under 200.

R & D: The company is staffed and equipped to carry out R & D projects on new types of resistor for military applications.



Mid-Canada Line diesel generator –Mechron Engineering Products

Johnson Matthey & Mallory Ltd., 110 Industry St., Toronto 15, Ont. RO. 2-7201. J. E. Shirreff, vice-president (local 4).

Parents: Johnson, Matthey & Co. Ltd., London, Eng., and P. R. Mallory & Co. Inc., Indianapolis, Ind. Subsidiary: The St. Catharines Brass Works Ltd., St. Catharines, Ont.

Products: Resistance wire, thermocouple wire, electrical contacts of all types and materials, slip rings, radar tuners, electrolytic, tantalum and silvered mica capacitors, glass-to-metal seals, and a wide range of products and services relating to precious metals and their treatment.

Facilities: one-storey brick, concrete and steel building of 102,000 sq. ft. Also a modern 11,500 sq ft sandcasting foundry at St. Catharines. Complete manufacturing and test equipment for the wide range of products listed. Total employees number 305, of whom 50 are concerned with capacitor manufacture.

R & D: Equipped and staffed for further product development in the general areas indicated above; also have access to the facilities of the parent companies.

George Kelk Ltd., 130 Willowdale Ave., Willowdale, Ont. BA. 5-7724. G. F. Kelk, president.

Products: Aircraft test equipment such as the Autosyn tester and gyro instrument test panel; industrial electronic equipment such as the transistorized digital extensometer; servo type voltage regulators. Previous contracts have been for flight test instrumentation for the Iroquois jet engine; jet engine temperature test sets; instruments for aero-medical research. Interested primarily in producing test equipment requiring careful engineering but in limited quantities.

Facilities: brick building with 4,000 sq ft on one floor. Equipped with semi-precision machine and sheet metal equipment, and facilities for production of printed circuits. Inspection procedures are based on RCAF requirements for approved suppliers. Military security clearance has not been required to date. Personnel includes 2 senior engineers, 4 junior engineers and engineering assistants, 2 draftsmen, 5 laboratory technicians and 7 production workers.

R & D: Senior staff members have adequate experience to undertake some types of research.

Kitchener Electronic Industries Ltd., 139 Dundas St., Kitchener, Ont. SH. 5-9770. E. Ritz, treasurer.

Products: Design and manufacture of intercommunication systems, line guards and electric chimes. Interested in designing and manufacturing other types of audio equipment.

Facilities: Two-storey cement block and steel building with bonded roof and total floor area of 13,000 sq ft. Production equipment includes a variety of meters, signal generators, analyzers and oscilloscopes, relevant to the testing and production of audio equipment. Personnel includes 1 design engineer, 1 production engineer, 1 tool and die design engineer, and 1 technician.

Lenkurt Electric Co. of Canada Ltd., 7018 Lougheed Highway, North Burnaby P.O., Vancouver, B.C. CY. 8-2464. H. R. Herron, marketing manager.

Parent: Lenkurt Electric Co. Inc., San Carlos, Calif.

Products: Wide range of carrier telephone systems for open wire lines, radio, and cable; fm microwave radio systems; carrier telegraph systems for wire or radio; and miscellaneous products for carrier and radio systems such as compandors, emergency ac power supplies, dial signaling systems, supervision and control systems, signal transmission equipment. Previous contracts have included radio multiplexing equipment for DEW line, carrier telephone and telegraph systems for NATO, special communication equipment for the Mid Canada line, supervisory and carrier telephone and telegraph equipment for ADCOM II, cable carrier telephone system for Canadian Army, radio carrier telephone system for RCAF, and radio carrier telephone system and fm microwave radio system for U. S. project Quick-Fix. Interested in manufacturing open wire, cable and radio carrier, signalling, alarm, supervisory, data, facsimile and associated test equipment.

Facilities: Two-storey office area with single-storey manufacturing facilities constructed of steel beams and reinforced concrete. Total floor area is 34,000 sq ft, plus 800 sq ft storage area in prefabricated metal building. Production equipment includes complete facilities for metal fabrication and finishing. A tool and die shop maintains power machines and dies, and designs and makes new tools, dies and jigs for metal fabrication. Six Lenkurt-designed toroidal coil winding machines provide capability of winding coils with cores from 2-in. to ¾-in. dia.

Facilities are maintained for the inspection of all incoming material and components, components manufactured within the company, and complete testing of individual circuits and complete systems under conditions to meet customer's transmission and operating requirements. Standards are maintained for frequency, capacitance and power. Anchor chain link fencing closes all shipping and receiving areas as well as all doorways with the exception of the main entrance. Guards are on duty at all times. Personnel includes 22 electrical engineers, 3 industrial engineers, 8 skilled technicians, 5 assistant engineers, 95 production people (39.5% skilled), 60 administrative, office and clerical staff. Security clearance has been obtained from DDP. A classroom, complete with working equipment, is maintained for training customer personnel on all types of Lenkurt equipment.

R & D: Personnel with specialized experience in the design of passive networks, supervisory and control circuits and systems, carrier telephone equipment and radio systems, are capable of carrying out research and development work. In addition, facilities of the parent company are available.

Long Sault Woodcraft Ltd., Saint Andrews East, Que. LO. 2-2438. J. A. Simpson, president.

Products: The company is primarily engaged in defence work, designing, developing, testing and fabricating equipment in reinforced plastic and foam. Products include ground-based radomes, air-borne radomes, support struts, wave-guide horns, heated horn screens, antenna beam vibrators, and shelters for Arctic and tropical use.

Facilities: The plant area of 20,000 sq ft contains materials handling equipment, hoists, machines for cutting and finishing wood, plaster, metal and plastic parts. There is a small laboratory for testing physical and chemical properties of the raw materials used. It also carries out the inspection of finished goods and can handle full scale mechanical tests on large equipments such as ground-based radomes. Personnel includes four graduate engineers, drafting, inspection and laboratory personnel. Present staff is 120 men operating on three shifts. Security clearance for key personnel is now under consideration by DDP.

Lucas-Rotax Ltd., 2200 Eglinton Ave. F., Toronto 13, Ont. PL. 5-4171. W. J. White (local 49).

Parent: Joseph Lucas Industries Ltd., Birmingham, England.

Products: AC and dc generating systems; magamp regulators; alternators; transistorized controls and protection devices; actuators; static inverters; rotary inverters; flasher units; motors (dc up to 50 hp at 112 v and dc up to 10 hp at 28 v); single and three-phase ac motors up to 50 hp; torque motors; de-icing equipment; transformers; solenoids; rotary transformers; blower motors; environmental-free alternators and associated controls; complete gas turbine fuel systems; pulse combustion heaters; industrial hydraulic pumps and motors. Previous contracts included the complete fuel system for the Orenda jet engine.

Facilities: Single story brick building in Toronto has a total area of 133,500 sq ft; in addition there are plants in Montreal, Que. (10,500 sq ft) and Vancouver, B.C. (4,500 sq ft). The engineering laboratories have been equipped for the development of aircraft electrical, hydraulic, and fuel systems. The Toronto plant also houses a machine shop, standards laboratory, heat treating shop, assembly area, plating and paint shop, metallurgical and chemical laboratory, computer room, test cells, fuel system and combustion laboratories. Inspection on all products is carried out in accordance with RCAF specifications. The plant has security protection and key personnel have obtained clearance for military projects. The company employs 500 people, 300 of them being at the Toronto factory, including 30 engineers.

R & D: Staffed and equipped to undertake development work on fuel and hydraulic systems, aircraft electrical systems, and new materials.

Mallory Battery Co. of Canada Ltd., 228 St. Helens Ave., Toronto 4, Ont. LE. 4-4201. J. Buchanan, vice-president, sales.

Products: Carbon, zinc and mercury batteries.

Facilities: Plant area 40,000 sq ft; 120 employees.

Marsland Engineering Ltd., 154 Victoria St. S., Kitchener, Ont. SH. 5-9486. G.M. Cox, vice-president and general manager.

Affiliate: Marsland Precision Equipment Co. Ltd. Licensed manufacturers for Canada of G. H. Leland, Inc., Dayton, O.; Sarkes Tarzian, Inc., Tuner Division, Bloomington, Int.; Filtors, Inc., Port Washington, L.I., N.Y.

Naval sound powered intercom control box—Measurement Engineering.

Products: Development, design and manufacture of a wide range of electronic components, servo systems, transistorized servo mechanisms and amplifiers. Examples include the loop antenna for the ARN/6 radio compass system for RCAF; bearing and range recorders for RCN fire control systems; plotting tables for navigational and tactical shipboard use (RCN); nuclear instrumentation for Atomic Energy of Canada Ltd.; mechanical tuning units for Collins Radio of Canada. Also mechanical differentials, magnetic clutches, precision gears and gear trains, etc.

Facilities: Brick and tile building providing 70,000 sq ft on two and three levels, with wide range of machine shop, sheet metal and assembly equipment. Employees total 269, including 19 in the engineering department.

R & D: Have facilities for the engineering of custom assemblies and equipment.

Measurement Engineering Ltd., Arnprior, Ont. 400. D. A. Bamford, general manager.

Products: Design and manufacture of communication equipment (transmitters, receivers and antennas), test instruments, radar displays, audio communication equipment, test sets, nuclear instruments, industrial controls and power supplies. Have also manufactured radiac meters and loran.

Facilities: The brick and masonry plant provides 16,000 sq ft on three floors. Complete sheet metal shop, small machine shop, engineering facilities and assembly area. Conventional quality control and inspection facilities are provided and there is a resident DND inspector. Several staff members have been cleared to Secret by DDP. Personnel include 5 management, 15 engineering, 15 sheet metal workers, 20 assemblers, 7 inspection and quality control, 7 on customer service.

Mechron Engineering Products Ltd., 2437 Kaladar Ave., Ottawa, Ont. RE. 3-3855. S. T. Ballantyne, president.

Products: Design and manufacture of power control panels, diesel generating plants, no-break power and control equipment. Interested in producing radiation monitoring equipment and electronic chassis assemblies (either as a prime or sub-contractor for the latter).

Facilities: Office and plant occupy two buildings with 6,500 sq ft for plant, 1,200 sq ft for stores, 1,800 sq ft for warehouse and 3,200 sq ft for office. Situated on 2 acres of land with a railroad siding. Plant facilities include a paint spray booth, engine test room with thermostatic control of ambient temperature for test runs, assembly area, engine repair and overhaul section, and electronic division with adequate test equipment for present manufacturing operations. All equipment receives complete operational test prior to shipment. Facilities have been provided for a resident government inspector when called for by contracts. The property is fenced and a watchman is on duty at all times while the plant is closed; security has been approved by DDP.

R & D: The company can draw on research information and staff if required from 10 companies with whom they have negotiated representation with rights to manufacture in Canada. These include electronic and nucleonic equipment and other items.

Canadian resources

C. C. Meredith & Co. Ltd., 80 Thomas St., Streetsville, Ont. TA. 6-1141. R. P. Scott, general manager.

Parent: Chicago Telephone Supply Corp., Chicago, Ill.

Products: Variety of electrical and electronic equipment including photoelectric lighting controls, tube and semi-conductor power supplies, telemetering equipment, magnetic amplifiers, battery chargers, motor-generator sets, control panels, relay panels, switchboards, regulators (voltage, current and/or frequency), mobile and engine driven generating sets, diesel normal-emergency power supplies, carbon and wire-wound variable resistors, mobile ground support units for starting jet aircraft, and custom industrial electronics.

Facilities: 38,400 sq ft equipped with machine tools, sheet metal working machines and plating and painting equipment. Test and inspection equipment cover electrical and environmental tests, also equipment for ceramics and paint development in chemical laboratory. Employees total 118, including 16 administrative, 5 engineering and 7 quality control and inspection.

Robert Mitchell Co. Ltd., 350 Decarie Blvd., Ville St. Laurent, Que. RI. 7-2471. G. H. Holland, general manager.

Products: Sheet metal enclosures, panels, etc. for electronic equipment; magnesium and aluminum castings; machined parts to close tolerances.

Facilities: Plant area 233,000 sq ft; 600 personnel.

Monarch Radio Mfg. Co., 3837 Arcade St., Montreal, Que. VI. 5-1540. D. Horlick, proprietor.

Products: Present products include portable record players, and small ac-dc radios. Interested in manufacturing public address equipment and intercommunication systems.

Facilities: Brick encased wooden building.

Muirhead Instruments Ltd., Stratford, Ont. 3717. R. W. Watler, asst. general manager.

Parent: Muirhead & Co. Ltd., Beckenham, England.

Affiliate: Muirhead Instruments, Inc., New York, N.Y.

Products: Synchros, servo motors, linvars, synchronous receivers, attenuators, frequency bridges, servo systems, electro-sensitive recording paper, and resistance boxes. Could develop and manufacture products in keeping with present facilities such as electro-mechanical control devices.

Facilities: The steel frame, brick panel, one-storey building contains 17,500 sq ft. Fully equipped machine shop, toolroom, quality control, test and development facilities. Air-conditioned areas include the inspection and gauge room, which is equipped with precision measuring instruments for quality control purposes. Plant has night-time flood-lighting and a police patrol. Staff totals 80 including administrative, production, inspection, development, sales and office personnel.

R & D: The company holds contracts for development of special instruments and employs a trained staff for this work.

National Fibre Co. of Canada Ltd., 197 Atlantic Ave., Toronto 3, Ont. LE. 2-3303. H. A. Frankel, vice-president and general manager.

Affiliates: National Vulcanized Fibre Co., Wilmington, Del.; New England Mica Co., Waltham 54, Mass.; Dixon Corp., Bristol, R.I., Bakelite Co., Belleville, Ont.

Products: Laminates and fabricated and formed parts and vulcanized fibre. Materials include phenolite-laminated plastics, teflon, nylon and rulon. Exacting electrical and mechanical requirements including high temperature resistance can be met.

Facilities: 30,000 sq ft fabrication plant in Toronto; laminating plant at Belleville, Ont. Complete equipment is maintained for treating and laminating thermo-setting plastics in sheets, tubes and rods. Also for fabricating and forming these materials and the production of the necessary dies, jigs and fixtures. Quality control tests are carried out to NEMA, CSA and ASTM specifications. Well-staffed with specialists in all phases of management, engineering, manufacturing, and quality control.

Communications equipment wiring to audio instructions–Northern Electric Co.

R & D: After many years of co-ordinated production and sales of laminated plastics with the Bakelite Co., National Fibre recently integrated the production facilities and skills of Bakelite with their own, including research and development efforts. Access is also available to the R & D facilities of the parent company.

National Semiconductors Ltd., 146 Bates Rd., Montreal 26, Que. RE. 7-4031. Dr. D. A. Anderson, president.

Products: Most varieties of Cadmium Sulphide and Cadmium Selenide photo-conductive cells; pure intermetallic semiconductor compounds such as InSb, GaSb; and semiconductor devices in general. Presently specializing in devices made from CdS & CdSe only.

Facilities: 1,200 sq ft of clean laboratory and production area in a brick and concrete slab construction building. Adequate facilities for manufacturing photoconductive cells, and some for development and test in various environments. Arrangements for quality control are flexible to suit customer requirements; 100% of products are tested for the parameters important to the customer. Long-term tests constantly in progress are aimed at improvement of the product. Plant is a locked, partitioned area on the second floor of a locked building. Personnel comprises three physicists, one with PhD, responsible for management, research, development and production; and four skilled production workers.

R & D: Key personnel each have 5-6 years' experience in semiconductor and photoconductor research, development and production; also additional experience in the general electronics field. Laboratory facilities include furnaces, test instruments, standards, humidity and high temperature life-test facilities.

Neosid (Canada) Ltd., 10 Vansco Rd., Etobicoke, Toronto 18, Ont. CL. 1-2831. W. M. Hamburger, manager.

Parent: Neosid Ltd., Welwyn Garden City, England. Affiliate: Neosid Ltd., Lilyfield, Australia.

Products: Powdered metal components for the electronics industry under the trade names "NEOSID" and "NEOCAST," comprising powdered iron cores for coils and transformers and microwave absorbing components for communications and military uses. These precision parts are produced from metal powders in large quantities on automatic and semi-automatic machinery to stringent electrical and mechanical specifications.

Facilities: One building of 4,300 sq ft with necessary production and test equipment, with a total present employment of 6 persons.

R. H. Nichols Ltd., 4544 Dufferin St., Toronto (Box 500, Downsview), Ont. ME. 3-8190. H. J. Davie, president and general manager.

Products: Supervisory controls, battery chargers, digital data transmitters, hf dielectric heating, switchboards, control desks, etc.

Facilities: Plant area 21,000 sq ft; 90 employees.

Northern Electric Co. Ltd., 1600 Dorchester St. W., Box 6123, Montreal, Que. WE. 7-8541. B. W. Chave, assistant to executive vice-president. Plants at Montreal and Lachine, Que.; Belleville and London, Ont.

Parent: The Bell Telephone Co. of Canada. Subsidiary: Dominion Sound Equipments Ltd., Toronto, Ont.

Products: Complete range of telephone apparatus and equipment including crossbar switching equipment, central office equipment of the Strowger type, microwave and video systems, carrier telephone and telegraph systems, electronic dc telegraph units, carrier telegraph and voice frequency signalling equipment. Semiconductor devices such as transistors, varistors and thermistors. High quality audio amplifiers, consoles and systems, industrial video transmission systems, am and fm radio transmitting equipment, radar and scatter communications equipment, fire alarm and traffic signal equipment, etc. Complete line of voice and carrier frequency communication cables and television cables, also wires and cables for overhead and underground transmission of power for home and industry.

Facilities: Total area of plants is 4,070,000 sq ft, including 1.8 million sq ft of manufacturing space and 1.2 million sq ft indoor storage space. Complete assembly facilities are available for either quantity production or individual units. Testing equipment is provided for finished apparatus, much of which is fully automatic and some is tape-operated. Other facilities include equipment for sheet metal work, screw machine work, woodworking, plastic molding, die casting, plating, anodizing, heat treating, and painting. Also special machinery required for wire and cable manufacture, including facilities for the production and testing of the long lengths of cable needed for the submarine transmission of communications or power.

Inspection and test facilities include all the equipment necessary to provide operational tests and a continuing audit of the quality of the company's wide range of products. Equipment provides for physical, chemical, electrical, mechanical and environmental testing of incoming materials, in-process products and finished goods. Special facilities have been arranged for tests on telephone and communications equipment, and on cable and wire products. Personnel totals 14,600, including 600 engineers.

R & D: Laboratories are operated in Montreal and Belleville which currently employ a staff of about 90 people of which about one third are scientific, the balance being technical and other supporting staff. The laboratories are fully equipped and are carrying out active research and development in the following fields—crystal growing investigation, floating zone refining, hall effect investigations, alloyed and diffused transistors, diffused silicon diodes, video distribution and monitor equipment, public address and broadcast systems, high quality microphones and acoustic devices, digital data processing equipment, data transmission, radio communications, low noise rf amplifiers, telephone carrier systems, telegraph and switching systems, and power transmission.

In addition, the Wire & Cable Laboratories carry out development work on the materials and methods of cable production. The company also has an Electrical Standards Laboratory equipped with standards for frequency, resistance, capacitance, etc. An IBM 650 computer is also located at the head office.

Northern Radio Manufacturing Co. Ltd., 1950 Bank St., Ottawa, Ont. RE. 3-4440. J. G. Macmillan, president.

Parent: Northern Radio Co. Inc., New York 11, N.Y.

Products: Development, design, manufacture and field engineering of a wide range of communications equipment including multi-channel tone systems, twinplex equipment, frequency shift converters and keyers, telemetering systems, monitors, diversity receivers, master oscillators, tone keyers, line amplifiers, demodulators, and tone filters.

Facilities: One-story cement block construction, two buildings, total 10,000 sq ft. Equipment for chassis fabrication and 4,000 sq ft of assembly area. Quality control department has manager and five inspectors and is responsible for all incoming and out-going inspection, as well as line inspection. The company's policy stresses the importance of quality control. Plant is protected by a watchman, and has security clearance from DDP. Personnel includes 2 management, 4 engineers, 11 technicians, 24 tradesmen and 5 others.

R & D: Interested in projects in the particular field of frequency shift radio communications equipment.

Osborne Electric Co. Ltd., 95 Wesley St., Toronto 18, Ont. CL. 9-7886. Gordon Y. R. Allen, president and general manager.

Products: Relays, coils, solenoids, transformers and communications apparatus as used in electric power utility system communications. Also manufacture tools, dies and molds.

Facilities: One-story concrete block building of 8,000 sq ft, built to accommodate a second story for expansion. Complete machine shop, tool room, punch press, coil winding, assembly and test facilities. Total average staff of 45, of whom all but 10 are electrical engineers, skilled technicians or toolmakers.

R & D: Equipped and staffed for relay development.

Pedaco Ltd., Box 156, Station "D", Toronto 9, Ont. HU. 5-5225. J. Pefhany, president.

Subsidiaries: Canadian Instrumentation Co., Audio Fidelity Associates, same address.

Products: No fixed products at present. Interested in the general area of instrumentation, data handling and industrial electronics. Have carried out consultation and design work in data handling, industrial measurement problems and electronic circuit design, and have products under development in these areas.

Facilities: Brick building of which 1,000 sq ft are available, suitable for assembly of electronic equipment.

R & D: Key personnel (J. Pefhany, R. Hobson and W. D. Coats) combine almost 20 years' experience in development, design and application of instruments, data handling equipment, transistorized computer logic, industrial electronics, cold-cathode and transistor electronics.

Peffer Sound Systems Ltd., 40 Maurice St. Kitchener, Ont. SH. 3-2628. L. L. Peffer, president.

Products: Sound system control panels and consoles, loudspeaker assemblies and grilles, switching assemblies for sound systems, and signalling apparatus.

Facilities: The plant is masonry construction with 2,500 sq ft on two floors. Manufacturing and test equipment is suitable for the production of the products listed above.

Philco Corp. of Canada Ltd., Don Mills Rd., Don Mills, Ont. HI. 4-2541. J. A. Price, manager, government and industrial division.

Parent: Philco Corp., Philadelphia, Pa. Subsidiaries: Philco Distributors Ltd., Montreal, Que. and Don Mills, Ont.

Products: Communication and TV microwave systems; transistors; closed circuit TV; electronic training aids. Previous military products include transmitters, power supply units, indicator units, power packs, dynamotor power supplies, and inter-communication units. Interested in designing and manufacturing all types of airborne and mobile radar, fire control and communications equipment, missile electronics, closed circuit television, and special test equipment.

Facilities: One building of steel and reinforced concrete with 80,000 sq ft houses all operations of the company. Approximately 60,000 sq ft are allocated to production operations, including facilities for the manufacture of radios, TV sets, electric ranges, and specialized government and industrial equipment. Total area presently allocated to engineering work is approximately 4,000 sq ft, of which 3,000 sq ft are laboratory area. In addition to this, there are approximately 4,000 sq ft of roof space allocated and properly enclosed which is used as an "on-the-air" test facility for the measurement of radar and communications type equipment in the microwave region. A separate quality control group has developed procedures which have been given the approval of DND and RCAF. The plant is protected by a 9 ft high fence and a 24-hour security guard patrol; security measures have been approved by DDP. Present staff includes 10 management, 15 engineers, 24 engineering technicians, 48 skilled production personnel and 90 unskilled shop personnel. This is for the government and industrial division only. Training facilities of the company are centred around the Philco training aid equipment.

R & D: The experience and equipment of the company are best suited to research and development in fields of radar and television. A range of environmental test equipment suitable for component and small unit testing forms part of the plant equipment.

Philips Electronics Industries Ltd., Electronic Equipment Group, 116 Vanderhoof Ave., Toronto 17, Ont. HU. 5-8621. H. L. Pollock, manager.

Parent: Philips Gloeilampenfabrieken, Eindhoven, Holland.

Products: Present products include ionospheric sounding equipment for 1-50 mc region; mobile communications transmitters and receivers; broadband transmitters; telegraph switching centres with central core memories; high speed data transmission networks. The company has developed and manufactured the CPRC-26, 50 mc portable transmitter/receiver; 20-70 mc tank set model AN/VRC-12; false alarm equipment for the Mid-Canada Line. Also interested in designing and manufacturing communication equipment for single and multi-channel use, both mobile and fixed-station; telemetry; and data transmission equipment.

Facilities: Manufacturing and engineering occupy 210,000 sq ft, with an additional 70,000 sq ft for warehousing, in brick building. Manufacturing facilities include a complete machine shop with milling machines, drills, punch presses, lathes, etc. A separate quality control and incoming inspection department operates in accordance with recognized commercial standards or special requirements on military contracts. The plant is surrounded by a fence, has alarm systems and security police; clearance has been obtained from DDP. The staff of 1,500 includes 3 research scientists, 24 development engineers, 124 engineers and technicians.

R & D: The company maintains a chemical laboratory, cold chamber, humidity and vibration testing facilities and pressure chamber. These are available for research and development work.

Phillips Electrical Co. Ltd., Kingston Rd., Brockville, Ont. DI. 2-5666. F. W. Barnhouse, general sales manager.

Parent: British Insulated Callender's Cables Ltd., London, England. Affiliate: Phillips Electrical Construction Co. Ltd., Brockville, Ont.

Products: Magnet wire including glass, dacron, paper and film coated types; control cables; telephone and communication cables; specialty apparatus cables The company is equipped to produce any other specialty wires and cables required by industry or the armed services.

Facilities: The company has three factories with a fourth under construction. The plant at Brockville has 377,356 sq ft; at Montreal, Que., there are 134,271 sq ft; at Vancouver, B.C., 71,899 sq ft. The plant at Halifax, N.S., now under construction, will have 606,845 sq ft. Plants are equipped for the production of all types of wire and cable, and incorporate machine shops for equipment repair. The Brockville plant has one of the best equipped laboratories in the industry, while the Montreal plant offers a complete telephone cable testing laboratory. Continuous and rigid inspection is carried out on raw materials as well as the manufactured products.

Plants are protected by fences and guards, and security measures have been approved by DDP. The company has one of the most complete staffs of skilled operators, particularly in rubber insulation, plastics, metal insulation and magnet wire.

R & D: Laboratories in Brockville and Montreal are equipped for wire and cable testing of all types. This includes metal testing of the copper as received, as well as other raw materials. The facilities are used for developing new products.

H. K. Porter Co. (Canada) Ltd., Federal Wire & Cable Division, 265 Suffolk St., Box 90, Guelph, Ont. TA. 2-6730. E. J. Goetz, general manager.

Parent: H. K. Porter Co. Inc., Pittsburgh, Pa.

Products: Extensive range of aircraft cable, aircraft ignition cable, annunciator cable, appliance wire, armored cable, asbestos cable, automotive cables, bare copper, building wires, control cables, cord sets, fixture wires and cords, flexible cords, harness assemblies, magnet wire, navy cables, radio wires, service cables, self-supportig aerial cable, street lighting cable, telephone wire and thermo plastic equipment wire. Some production machines and dies are also manufactured.

Facilities: Manufacturing is done in a single story steel and brick building with facilities suitable for manufacturing the electrical wires and cables listed above, including a machine for extruding Teflon-insulated wire. Inspection is performed on a sampling basis, ranging from 10% to 100% of production. Plant is surrounded by a high steel wire fence and there is a 24-hour guard system; security clearance has been approved by DDP.

R & D: Product development is carried out under the direction of E. A. Pollard, chief engineer.

Potter & Brumfield (Canada) Ltd., 135 Oxford St., Guelph, Ont. TA. 2-0390. A. Laws, plant manager.

Parent: Potter & Brumfield Inc., Princeton, Ind., a member of the American Machine and Foundry group.

Environmental laboratory for resistors — Precision Electronic Components

Canadian resources

Products: Electro-magnetic relays of the following types — impulse, keying and break-in, latching photo-electric, polarized, power, resistance activated, sensitive, sequence, stepping, overload, sub-miniature and telephone.

Facilities: 15,000 sq ft in one stone building with good shipping facilities. The company has just established its manufacturing facilities in Canada and has plant capacity that would permit 50% over the present production rate. Quality control inspectors check all products at various phases from incoming to final inspection before shipping. Staff includes fully experienced management and technical personnel.

R & D: Access to facilities of parent company is available to assist in the development of new relay products.

Powertronic Equipment Ltd., 50 Bermondsey Rd., Toronto 16, Ont. PL. 5-3377. B. W. Richardson, president.

Products: Special process control panels; battery chargers; engine generators; dc power supplies; pipe line heaters; induction generators; generator controls, switchboards; ground detectors; dielectric generators, annunciators; motor controls.

Facilities: 14,000 sq ft on one floor in a brick building. Production equipment includes a sheet metal fabricating shop, machine shop and complete electrical test facilities. Quality control is carried out in accordance with recognized commercial standards on both components and complete apparatus. Of the 50 personnel, 5 are in engineering, 4 in test and inspection, 25 are skilled plant personnel, 5 in management, 3 performing services and 8 doing general duties.

R & D: Personnel in the engineering and test departments are capable of carrying out development work.

Precision Electronic Components (1956) Ltd., 50 Wingold Ave., Toronto 19, Ont. RU. 1-6174. A. Simoni, president.

Affiliates: Atlas Radio Corp., Radio Components Ltd., Automatic Coil Ltd., same address.

Products: Variable composition resistors for military and industrial use. Type L has been approved to MIL-R-94A and tests for style RV-4 in accordance with MIL-R-94B are in progress; type RA has been approved to MIL-R-94A and tests for style RV-5 in accordance with MIL-R-94B are in progress; type SN (½ in. diam.) is undergoing a test for style RV-6; types T & U (⅜ in. diam.) meet the general and environmental requirements of MIL-R-94. Type RA has a diameter of only ¾ in. but is rated at 1½ watts.

Facilities: 50,000 sq ft of plant area are shared with affiliated companies. The machine shop is equipped with 5 presses ranging from 20 to 200 tons, 2 milling machines and 4 screw-cutting machines. The testing laboratory is capable of performing tests to most MIL specifications with the exception of vibration and shock.

R & D: Interested in and capable of undertaking R & D projects for small electronic components. Several projects have been undertaken for the Defense Research Board and all products manufactured by the company are of its own design.

Pye Canada Ltd., 84 Northline Rd., Toronto 16, Ont. PL. 9-2231. A. J. Capstick, general manager.

Parent: Pye Ltd., Radio Works, Cambridge, England.

Products: At the present time the company is providing sales and service only on a complete range of am and fm fixed stations and mobile radios, transhailers and amplifiers. It acted as prime contractor for the production of the AN/SQS-501 sonar set for RCN. The Television Transmission Division at Ajax, Ont., has additional facilities. It did the system engineering then outfitted HMCS Bonaventure with closed circuit television for internal communications purposes.

Facilities: 5,700 sq ft in one cement-block building. Test equipment is maintained for tuning and testing of radio-telephone equipment. Total staff of 15 includes 4 technicians.

R & D: All engineering and testing facilities of the parent company are available.

Quality Hermetics Ltd., 45 Hollinger Rd., Toronto 16, Ont. PL. 7-2869. Harold A. Cohen, general manager.

Affiliates: Hermetic Seal Corp., Newark, N.J. and Hermetic Pacific Corp., Pasadena, Calif.

Products: Design, fabrication and testing of glass-to-metal hermetic seals, including single terminal feed-throughs, stand-offs, multi-terminal headers, crystal transistor and diode bases, housings and mounts, end seals, connectors and special terminations employing the glass-to-metal principle for vacuum and pressure-tight applications; furnace brazing of connectors, assemblies and housings, etc.; hot tin dipping; fabrication of special assemblies such as squibs, military fuzes, etc.

Facilities: Two buildings totalling 8,000 sq ft with complete facilities for all phases of manufacture from the basic glass processing and metal part fabrication, through fuzing, surfacing, to finishing and testing. The company's emphasis on quality has led to 100% support of Canadian equipment manufacturers utilizing glass-to-metal seals in their products. Present employees number 21, but could be increased with present facilities to more than double this number.

R & D: Complete facilities for the development and research investigation of glass-to-metal seals are available within the company.

RCA Victor Co. Ltd., 1001 Lenoir St., Montreal, Que. WE. 3-7551. H. B. Goodwin, vice-president, defence marketing.

Parent: Radio Corp. of America, New York, N.Y.

Products (Related to defence production): Heavy radar, microwave relay equipment and systems, hf and lf communications equipment up to 250 kw, tropospheric scatter equipment, ssb equipment, antennas and electronic components for guided missiles, tubes and semiconductor devices. Have previously produced defence equipment in the areas of radar, airborne communications, airborne electronic systems, doppler detection equipment, lf and hf high power transmitters, mobile microwave relay systems, sound powered telephones, shipboard battle announce systems, AFV communications equipment, lf, hf & microwave antennas, radar scanners and instrument landing systems. Also capable of producing ground support equipment for guided missiles.

Facilities: Multi-story brick and reinforced concrete head office and main plant at Montreal has an area of 321,000 sq ft; other plants at Prescott, Renfrew, Owen Sound and Smiths Falls, Ont. have a total area of 389,500 sq ft. Fully integrated production facilities for all products, including production machine shop and sheet metal shop; metal finishing facilities including cleaning, paint finishing, baking and electro-plating; anti-corrosion treating facilities for aluminum and magnesium alloys; shielded arc and aluminum spot welding facilities, with certificated welders; assembly areas, both bench and floor; tool room; and engineering model shop. Complete electrical and mechanical test and inspection facilities and equipment for all products and activities include gauge room and electrical standards.

Quality control arrangements comply with RCAF Proc. 101-1 and MIL-Q-5925C. A quality assurance organization under the engineering department audits quality control operations. Plant is protected by perimeter fencing and 24-hour security guard service, and is approved by DDP. Design engineering personnel includes approximately 150 professional-level engineers, special fields of activity being heavy radar, microwave relay systems, high power transmitters, airborne electronic systems and antennas. Unusually complete environmental laboratory capable of testing equipment, components, packages and systems under a wide range of atmospheric, dynamic and steady-state conditions. This laboratory includes climatic simulator equipment, mechanical and electro-dynamic vibrators, shock test machines, centrifugal accelerator, and complete instrumentation and data reduction equipment.

R & D: RCA Victor operates in Montreal a complete systems management team comprising research and development personnel, maintainability and quality control, equipment engineers, as well as systems management under a single group. The research laboratories are fully equipped for work in semiconductor material devices and applications, microwaves and systems, with personnel comprising 20 scientists and engineers, including 10 PhD's.

Radio Components Limited, 50 Wingold Ave., Toronto 19, Ont. RU. 1-6174. D. Lou Harris, general manager.

Affiliate: Oak Manufacturing Co., Chicago, Ill.

Products: Coils, antennas, and a wide variety of switches including rotary, push-button, slide and other types. Facilities are suitable for manufacturing other types of electronic components.

Facilities: Brick building of 45,000 sq ft fully equipped with tool room, lathes, punch presses, milling machines, eyeletting machines, coil winders, etc. Employees total 74 including a fully qualified management and engineering staff.

Radio Condenser Co. Ltd., 6 Bermondsey Rd., Toronto 16, Ont. PL. 5-2235. C. D. Murdock, managing director.

Parent: Radio Condenser Co., Camden, N.J. Agents for: Price Electric Corp., Frederickton, Md. (relay manufacturers).

Products: Design and manufacture of variable capacitors and tuners for automobile radio and television receivers, also military types of variable capacitors and tuners.

Facilities: One-story brick building of 20,000 sq ft with full production and machine shop equipment, and well-equipped inspection department. Employees number 140.

Radio Engineering Products Ltd., 1080 University St., Montreal, Que. UN. 6-6887. C. B. Fisher, president. Manufacturing plant at Granby, Que.

Products: All forms of communication equipment, including mobile communication centres, carrier telephone and telegraph multiplex equipment, wave filters, equalizers, transformers and similar components, point-to-point radio link equipment, telephone dials, cables and cable connectors.

Facilities: General offices are located in Montreal with development laboratories and manufacturing plants in Granby, some 45 miles east of Montreal. Present production facilities consist of five plants with a total floor space in excess of 125,000 sq ft, capable of accommodating a staff of about 2,500 employees. Approximately 90,000 sq ft is presently in use, with about 500 employees. Plant is equipped with a wide range of machine tools, sheet metal working, welding, plating, winding and other machinery and considerable test, inspection and development equipment, including environmental test.

R & D: Company is equipped for and has experience in the development of communications products.

Raytheon (Canada) Ltd., 61 Laurel St. E., Waterloo, Ont. SH. 3-5281. J. J. McGrail, contract sales manager, Commonwealth Bldg., 77 Metcalfe St., Ottawa, Ont.

Parent: Raytheon Manufacturing Co., Waltham, Mass.

Products: Radar, radar display equipment, radar navigational aids, missile systems, tubes, etc.

Facilities: Plant area 20,000 sq ft; 130 employees.

Rogers Electronic Tubes & Components, a Division of Philips Electronics Industries Ltd., 116 Vanderhoof Ave., Toronto 17, Ont. HU. 5-8621.. J. Pounder, product manager, receiving and picture tubes; D. S. Simkins, product manager, transmitting and special purpose tubes; J. Beardall, product manager, semiconductors and transistors.

Parent: Philips Gloeilampenfabrieken, Eindhoven, Holland. Associates: Amperex Electronic Corp., Hicksville, N.Y. and Mullard Ltd., London, England.

Products: Receiving, small transmitting, military gas-filled and cathode ray picture tubes. Capable of manufacturing frame-grid receiving tubes, special small gas-filled types, geiger tubes, glass-enclosed crystals, and professional filters.

Facilities: Adequate production areas and equipment for products listed. Stringent quality control procedures are followed for all products. Plant protected by fences and security guard system.

Servomechanisms (Canada) Ltd., 123 Rexdale Blvd., Rexdale (Toronto), Ont. CH. 4-5376. C. H. Hartley, president; John H. Pile, chief of technical sales.

Parent: Servomechanisms, Inc., Hawthorne, Calif. and Westbury, L.I., N.Y.

Products: Design and production of precision control systems, computers and instrumentation for military and commercial aircraft and missiles, and other scientific and industrial applications. Products include a range servo (airborne analog computer), missile launch computer (airborne guided missile fire control), power control unit (power switching device for computer and missiles), intervalometer (airborne stores release controller), 400 and 60 cycle servo amplifiers, power supplies, modulators, aircraft yaw

angle indicating system, special purpose test equipment, custom industrial control systems.

Facilities: One-story modern fire proof brick building, 20,000 sq ft on 4-acre site. Layout designed specifically for precision electronic and electro-mechanical engineering and production, including precision metal fabrication shop, assembly area with capacity for 120 workers, air-conditioned, dust-free area, centrally located stores area, painting and other facilities. Plant is protected by screens on engineering area windows and completely segregated areas for classified work, approved for Secret projects by DDP. Plant also contains a large fully-equipped test laboratory and incoming material inspection area. Quality control procedures, in accordance with Proc. 101-1, are emphasized throughout all operations; facility carries RCAF approval No. R. 071-11/55. Personnel total 66, including 6 management, 14 technical, 36 skilled, and 10 unskilled.

R & D: Technical staff have a well-demonstrated competence in original conception, detailed study and product development in all phases of the company's business. Facilities for experimental engineering and research can accommodate any applicable program.

Sharpe Instruments Ltd., 6080 Yonge St., Willowdale, Ont. BA. 1-8733. J. Gordon Elder, sales manager.

Products: Precision electro-mechanical and optical instruments, particularly for geophysical application. High fidelity headphones with liquid-filled cushion for comfort and 40 db noise attenuation, wide frequency response with low distortion; also available with integral noise-cancelling microphone.

Facilities: 2-story brick building of 8,000 sq ft plus garage; offices in Toronto and Buffalo, N.Y. Precision machine shop with lathes, milling machines, etc.; optical grinding facilities; paint spray room and oven baking; plastic moulding room; and instrument repair areas. Each phase of production has its own inspector, a wide variety of mechanical and electrical test and measurement equipment being carried. This includes a frequency response tracer and microphone amplifier for testing of headphones. Employees total 35, including 1 management, 3 engineers, 2 geophysicists, 8 skilled machinists, and 5 electronic technicians; also assemblers, office staff, draughtsmen and field service personnel.

R & D: Research and development on geophysical instruments is a continuous effort, a geophysicist, an engineer and 2 technicians being engaged continuously on this work.

SIDO Ltd., 555 Blvd. Boivin, Granby, Que. FR. 8-4955 and Montreal UN. 1-6472. S. Giguere, manager.

Products: Complete line of terminal lugs approved by CAMESA, high quality screw machine products, gears and gear train assemblies, small screws to U. S., European and British standards in any material.

Facilities: 10,000 sq ft in one building, with all necessary machine tools for production of the items listed, including precision gear-cutting machinery.

Sinclair Radio Laboratories Ltd., 21 Toro Rd., Box 179, Downsview, Ont. CH. 4-5519. P. Yachimec, general manager.

Products: Antennas for communications, shipborne, airborne and land radio-telephone applications; filters, duplexers and multi-couplers for common antenna work; waveguide components and test equipment; rf oscillators using transistors. Capable of work on infrared systems and other transistorized rf equipment.

Facilities: Modern concrete block and brick building 7,200 sq ft on 2 acres of land, with good manufacturing and test facilities. Equipped with model shop and small-run production facilities, other local shops being utilized on a sub-contract basis. Plant security approved by DDP and arrangements for quality control are considered adequate to meet necessary military standards. 25 employees, including 7 graduate engineers, 3 with PhD degrees, all specializing in communications and electromagnetic wave research work.

R & D: Equipped and staffed for research and development projects pertaining to antennas and related problems. Key personnel include Dr. George Sinclair, Dr. W. V. Tilston, and Dr. J. R. Richardson.

S. G. Smallwood Ltd., 391-397 King St. E., Kitchener, Ont. SH. 5-9583. S. G. Smallwood, president.

Products: Radio frequency coils for radio, television, other electronic equipment and special coils for defence purposes. Coils have been supplied on a sub-contract basis for many defence applications. Also capable of undertaking chassis assembly and wiring.

Facilities: 2-story brick building of 18,000 sq ft, also 17,000 sq ft rented factory in Acton, Ont. Fully equipped with 55 winding machines, 5 punch presses, 4 drill presses, 2 lathes, 1 shaper, 2 compressors, numerous air cylinders for automatic equipment, and a well-equipped laboratory. Adequate test facilities, DND inspectors visiting plant as required. Plant security is approved by DDP. Personnel totals 120, including 6 in engineering department.

C. R. Snelgrove Co. Ltd., 141 Bond Ave., Don Mills, Ont. HI. 4-1107. C. R. Snelgrove, president.

Products: Quartz crystals and crystal ovens.

Facilities: One-story modern steel and brick building of 13,500 sq ft, containing all specialized production and test equipment necessary for this particular line of products. Employees total 45.

Sonneborn Ltd., 133 Laird Dr., Toronto 17, Ont. HU. 1-6406. A. E. Adam, manager.

Parent: L. Sonneborn Sons, Inc., New York, N.Y.

Products: Paints and coatings for buildings, etc., Special sealants have been supplied for sealing joints in geodetic radomes.

Facilities: 3 one-story concrete block buildings, total 20,000 sq ft, including special equipment required for this class of product and a central laboratory.

Sparton of Canada Ltd., Elm St., London, Ont. GL. 5-6320. B. Graham, vice-president in charge of engineering.

Parent: Sparton Corp., Jackson, Mich.

Products: Radio and television receivers, high fidelity record players, phonograph records, wire and metal parts, and defence electronic equipment such as sonobuoys, etc. Have supplied military requirements for radar, sonar, panel instruments, and special radio gear.

Facilities: 23 brick and concrete buildings with a total area of 103,600 sq ft. Production facilities include sheet metal press shop, welding shop, plating department, painting and baking department, and 3 production departments for assembly including lines and conveyors, also engineering and design department and general offices. Large inspection and quality control division based on component and product approval tests, production test inspection, sampling procedures and final quality control check on all products. Plant is fenced, has 24-hour security controls and is cleared by DDP. Personnel comprises president and 4 department managers, office manager, 30 office staff, 20 foremen and production staff, 15 inspection staff, 200 skilled and semi-skilled production workers, 6 maintenance workers; also an engineering department comprising 1 chief, 4 department heads and 10 technical assistants.

R & D: Development work has been done on all Sparton Canadian products and some special government R & D contracts.

Spaulding Fibre of Canada Ltd., 70 Coronet Rd., Toronto 18, Ont. BE. 3-2151. T. C. Drees, vice-president.

Parent: Spaulding Fibre Co. Inc., Tonawanda, N.Y.

Products: Laminated phenolic, melamine, epoxy sheets, rods, tubes and fabricated parts; vulcanized fibre, fish paper, insulating paper, fibre board and pressboard, and fabricated parts from these materials. Terminal boards, gaskets, bushings and insulators have been supplied for military applications on a sub-contract basis.

Facilities: One-story building of 15,000 sq ft with wide range of machine tools and hydraulic forming presses. Inspection is well-equipped and headed by a former government inspector with 20 years experience. Personnel comprise 8 management of whom 4 are professional engineers and 12 shop personnel.

Sperry Gyroscope Co. of Canada Ltd., Box 710, Montreal, Que. RI. 7-5561. R. H. Littlefield, director of contracts.

Parent: Sperry Rand Corp. Subsidiary: Sperry Gyroscope Ottawa Ltd., 3 Hamilton Ave., Ottawa, Ont.

Products: Design, development and production of aeronautical marine instruments and systems including aircraft flight and navigational instruments, marine navigational instruments, airborne radar, radar test equipment, transistor and magnetic amplifiers, servo systems, and gyroscopic instruments. Also industrial control systems and general electronic circuitry, particularly as applied to digital computation equipments. Present products include AN/APN-502 navigational radar set, LDG-1 directional aircraft gyro, AN/FPS-35 antenna bearing instrumentation system, AN/FPS-35 receiver group, Mk. 23 marine gyro compass, numerical controls, ground support equipment and an airborne stable platform. Company has also supplied aircraft compass systems, altimeters, air speed indicators, machmeters, electromagnetic log equipment, and nuclear reactor control systems.

Hi-fi headphones—Sharpe Instruments

Facilities: 90,000 sq ft of which 60,000 sq ft is manufacturing area and the remainder office and service areas. Equipped for the manufacture of jigs, tools, fixtures and parts for development or production; assembly area for wire processing and harness assembly; photo printing and etching of printed circuits; dynamic balancing; temperature-controlled area; heat treating and plating facilities. Plant security measures are approved by DDP and quality control department procedures by DND Inspection Services and Air Materiel Command of the RCAF. Employees total 360, including 180 direct labour, 200 indirect. Engineering department has a staff of 80, of whom 45 are graduate engineers.

R & D: Engineering staff has collective experience in research and development, particularly in the fields of target positional data handling, semiconductor circuit development, radar, digital and analog computation, control equipment, servo systems and printed wiring techniques. Development laboratory is equipped with electronic, servo and radio frequency test equipment and a wide range of stock components for rapid construction of development models.

Spilsbury & Tindall Ltd., 120 E. Cordova St., Vancouver 4, B.C. MU. 4-4131. A. J. Spilsbury, president. Sales: S & T Sales Ltd., same address.

Products: Marine, land, portable and mobile mf and vhf radio telephones; radar sub-chassis.

Facilities: Three-story brick and frame building, 18,000 sq ft. With sheet metal, crystal manufacturing equipment, and moving-belt assembly line with corresponding equipment. Complete range of test equipment for the electronic products made, also environmental test chambers and other development type equipment.

Standard Telephones & Cables Mfg. Co. (Canada) Ltd., 9600 Lawrence Blvd., Montreal 12, Que. DU. 9-8221. T. C. Lewis, commercial department.

Associate company of International Telephone & Telegraph Corp., New York, N.Y.

Products: Radio navigation and telecommunications equipment including radio beacons, VHF/ADF transmitters, communications transmitters, transformers, telephone carrier equipment. Also system engineering and installation of microwave radio relay links for television and general communications.

Facilities: Combined administration, engineering and manufacturing plant, with 110,000 sq ft of floor space containing completely equipped machine shop, and large assembly area with all supporting services. Plant area is fenced and all or part of the facilities can be secured against unauthorized entry; clearance has been obtained from DDP. Quality control department is experienced in handling defence contracts and has a resident DND inspector. Approvals for transformers have been received from CAMESA to specifications JCNAAF-T-19 and MIL-T-27A. Employees number approximately 250, and the company can also fall back on the resources of the associated system companies which include 79 plants and laboratories and 110,000 employees.

Canadian resources

R & D: Research and development is not a normal function except for adaptive engineering to Canadian requirements. Facilities include a temperature/humidity chamber, vibration table and shock testing machine. A Stantec ZEBRA computer will be available at Montreal later this year.

Standard Television Products Ltd., 108 Sydney St. S., Kitchener, Ont. SH. 3-4324. N. F. Futher, production manager.

Products: Radio, television and other electronic transformers, chokes, and other iron-core components. Capable of supplying small electronic assemblies, power supplies and special iron-core components to military specifications. Previously supplied types CPP-2 and CPP-5 12-24 volts power supplies for military application.

Facilities: Two steel and brick buildings with a total area of 23,000 sq ft, equipped with machine tools, vacuum impregnation equipment, coil winders and a general assembly section. Quality control department carries out 100% inspection on production with suitable equipment. Personnel comprise 8 administrative, 2 engineers, 9 foremen and 85 male and female production workers.

Stanwyck Coil Products Ltd., 17 Laurier St., Box 1049, Hawkesbury, Ont. ME. 2-6651. N. Knowlton, sales manager.

Parent: Stanwyck Winding Co. Inc., Newburgh, N.Y.

Products: Encapsulated inductors, pulse transformers, i-f transformers, audio and rf transistor transformers, and ferrite rod antennas for special applications. Also capable of manufacturing 455 kc filters and small electromechanical assemblies.

Facilities: One-story brick building, 7,800 sq ft, with all necessary winding machines, punch presses, etc. Also machine shop capable of manufacturing own production equipment. Adequate electrical test equipment and temperature chambers for tests from —65 to +250 deg C; also use statistical quality control to military specifications. Staff includes 8 administrative, 4 engineering, 1 manufacturing engineer, 1 technician, 3 quality control, 2 machinists and 50 production workers, of whom 70% are skilled.

R & D: Interested in projects in the development of miniature inductors using ferrites; chief engineer has wide experience in this field.

Stark Electronic Instruments Ltd., Box 670, Ajax, Ont. Ajax 125 & Toronto EM. 8-3806. M. J. Stark, president. Sales: Stark Electronic Sales Co., same address.

Affiliates: In addition to manufacturing activities, the company also acts as authorized Canadian agents for several U. S. electronic instrumentation companies.

Products: Electrical indicating instruments for the military and commercial fields, analyzers, oscilloscopes, tube testers, etc.

Facilities: Complete tooling for production of ac and dc meters and shunts; also machine shop and painting facilities. Inspection department has all facilities necessary for the testing of all types and ranges of ac and dc meters. Also a complete set of standards and such equipment as is necessary for the manufacture, repair and overhaul of all types of electronic test equipment and telecommunications equipment. Company employs 124 people, including 5 engineering and 12 quality control and inspection, in a plant of just over 21,000 sq ft.

Stegg Electric Ltd., 34 Bertram Blvd., Box 211, Belleville, Ont. E. S. Stephenson.

Products: Telephone relays and contactors.

Facilities: Concrete building of 2,000 sq ft, with machine shop, tool and die making, heat treating, plating, annealing and spot welding equipment and assembly areas. Personnel, adequate for present production, include tool and die makers, press and machine operators and relay testers.

Stewart-Warner Corp. of Canada Ltd., 349 MacDonald Ave., Belleville, Ont. WO. 8-6760. George F. Brooks, controller.

Parent: Stewart-Warner Corp., Chicago, Ill.

Products: Radio and television communications equipment, IFF & SIF equipment, asdic repair and overhaul, and first line test equipment.

Facilities: 71,800 sq ft, completely equipped for production of the items listed. Total employment of 234 people includes 8 engineering and 6 quality control, the latter having a very wide range of test equipment available.

Syntron (Canada) Ltd., 928 Queenston Rd., Box 910, Stoney Creek, Ont. NO. 2-8314. W. B. Armstrong, general manager.

Parent: Syntron Co., Homer City, Pa. (Subsidiary of Link Belt Co., Chicago, Ill.).

Products: Selenium and silicon rectifiers, electric vibratory materials handling equipment, automation devices. Also capable of manufacturing electronic sub-assemblies and custom semi-conductor devices.

Facilities: Two-story brick building, 15,000 sq ft, with light punch press and sheet metal facilities, automatic and semi-automatic assembly, grading and testing equipment, general electronic and electrical test laboratory. Trained inspection personnel have electronic and electrical test equipment and some environmental test equipment. Personnel comprise 5 management, 8 skilled technicians, 30 semi-skilled, and 2 unskilled workers.

R & D: Highly-trained technical group in semiconductor theory and application, backed by the resources of the parent company's organization.

T.M.C. (Canada) Ltd., R.R. 5, Ottawa, Ont. TA. 2-0244. H. C. Ashdown, vice-president. Plant: River & Limebank Rds., Ottawa.

Parent: The Technical Material Corp., Mamaroneck, N.Y.

Products: Wide range of telecommunications equipment including transmitters, amateur and general purpose receivers, single side-band systems, antenna multicouplers, antenna accessories (transformers, dissipators, etc.), frequency shift exciter systems, remote control equipment and power supplies.

Facilities: One main building with 18,000 sq ft. The metal shop has painting and etching facilities for all chassis and panel work. Quality control is carried out with recognized commercial standards, or in accordance with special requirements on military contracts. The plant is patrolled by a watchman and security measures have been approved by DDP.

R & D: The company has facilities for developing its own products and can also utilize the facilities of its parent company.

Taylor Instrument Companies of Canada Ltd., 75 Tycos Dr., Toronto 19, Ont. RU. 7-1651. E. J. Sheare, managing director.

Affiliates: Taylor Instrument Companies, Rochester, N.Y.; Taylor Controls Ltd., London, England; Short & Mason Ltd., London, England; Taylor Instrument Companies of Australia, Pty., Victoria, Australia.

Products: Industrial instruments for measurement and control of process variables such as temperature, pressure, flow, liquid level, force. This includes thermometers and gauges for ships and automatic controllers for plants.

Facilities: Plant area is 40,000 sq ft in single-floor building of brick construction. Manufacturing facilities include a machine shop equipped with lathes, drill presses, etc. Inspection department under the engineering department carries out quality control inspection in accordance with recognized commercial standards. The building is surrounded by a fence except for the office area which faces the street. Protected by Dominion Electric Protection Service. Total number of employees is 125. There is an application engineering department responsible for installation and application of instruments; an engineering department for design and advice on instrument construction; sales force consisting primarily of graduate engineers.

R & D: The company relies upon its affiliates for development and research.

Taylor-Leslie Mining & Engineering Corp. Ltd., 9 Wellington St. E., Box 312, Terminal "A", Toronto, Ont. EM. 6-2559. G. A. Taylor, president.

Products: Diodes, silicon rectifier stacks, and solar switches.

Facilities: Total floor area is 3,000 sq ft with production and test facilities suitable for the products listed above. Security clearance has been approved by DDP.

Telegraph Condenser Co. (Canada) Ltd., 50 Bertal Rd., Toronto 15, Ont. RO. 6-6123. A. J. Bauer, president.

Parent: Telegraph Condenser Co. Ltd., London, England.

Products: Aluminum & tantalum capacitors. Interested in producing other types of capacitors.

Facilities: Total floor area is 8,600 sq ft in a new building. Workshop is equipped with milling machine, drill press, etc. Quality control equipment includes an assortment of bridges, power supplies, electrolytic resistance test equipment, production test equipment for capacitance, leakage and power factor.

R & D: Facilities for development of new products include humidity chamber, cold chamber, analytical balance, microscope and other laboratory equipment. The company is doing research on capacitors under a contract from the Canadian government.

Thermo Electric (Canada) Ltd., Box 10, Brampton, Ont. GL. 1-0813. G. S. Martin, sales manager.

Parent: Thermo Electric Co. Inc., Saddle Brook, N.J.

Products: Temperature measurement and control equipment for aircraft, atomic and industrial use including thermocouples, thermocouple wire, thermo-wells, harness, plugs and jacks, connector panels, thermocouple selector switches, temperature indicators, electronic temperature controllers, indicators, recorders, monitors, special instruments and resistance bulbs.

Tinsley Instruments (Canada) Ltd., Box 99, Smiths Falls, Ont. 2539. J. Sutcliffe, general manager.

Products: Electrical instruments and standards for standards laboratories, including measuring potentiometers with an accuracy to $\pm 0.0002\%$. Galvanometers, resistance standards, capacitance standards, inductance standards, standard cells, bridges, special instruments to customers specifications.

Facilities: Plant area is 4,000 sq ft including a machine shop, woodworking shop, electrical wiring department and standards room. Production equipment is suitable for the construction of precision galvanometers and other instruments, winding facilities can handle fine wire down to 0.0006 in. dia. The standards room is fully equipped to provide a calibration services in accordance with the requirements of the National Bureau of Standards. The staff of 20 includes 1 professional engineer and 3 specialists in instrument construction. The remaining staff consists of skilled instrument makers.

Titania Electric Corp. of Canada Ltd., Box 672, Gananoque, Ont. 81. M. H. Fallis, secretary-treasurer.

Parent: Gulton Industries Inc., Metuchen, N.J.

Products: Thin sheet dielectrics, hydrophones, special ceramic transducers for very high power application, thermistors, high-reliability thin sheet ceramic capacitors produced from a prepared ceramic material. The company is interested in producing other special ceramic dielectrics and piezoelectric ceramics.

Facilities: One-story steel and asbestos building, 6,000 sq ft, situated on 30 acres of land. Production machinery includes ball mills, hydraulic presses, slip casting moulds, kilns, diamond saws and grinders, polarization equipment. Extensive testing is carried out for quality control utilizing chemical, electrical and visual methods. Security measures up to the category of Secret have been approved by DDP. Staff includes 3 graduate ceramic engineers and 2 graduate electrical engineers.

R & D: The Company has been awarded two DDP contracts for research on prepared ceramic material and a feasibility study on a ceramic production facility for Canada.

F. V. Topping Electronics Ltd., 94 Laird Dr., Toronto 17, Ont. HU. 7-1546. F. V. Topping, proprietor.

Products: Transistorized high frequency radio telephones; frequency shift exciters; portable and mobile audio amplifiers; custom production. Interested in doing design and manufacture of transistorized communications equipment and accessory units.

Facilities: Self-contained plant with 10,000 sq ft on one floor of a brick building. Includes testing laboratory, model shop, assembly area, offices and storage. Normal commercial quality control is carried out except where different procedures may be specified by the customer.

Key personnel have been cleared to the category of Secret. Capable of developing production prototypes in accordance with customer's specifications.

TranSonic Ltd., McMaster Ave., Ajax, Ont. 1510. W. Jones, president.

Products: Ultrasonic mixers, ultrasonic cleaners, and transducers. Also interested in the development and manufacture of sonar and control equipment.

Facilities: 2,500 sq ft on one floor. Laboratory and manufacturing facilities suitable for the design and production of ultrasonic systems. Plant security measures have been approved by DDP.

R & D: Senior personnel are capable of undertaking development projects in the field of ultrasonics.

Truck Engineering Ltd., Box 209, Woodstock, Ont. LE. 7-3461. V. B. King, president.

Products: Mobile trailers of all types, including pole and cable reel trailers.

Facilities: Plant area 85,000 sq ft; 200 employees.

United-Carr Fastener Co. of Canada Ltd., 231 Gage Ave., N., Hamilton, Ont. LI. 4-5791. J. R. Johnston, vice-president sales.

Parent: United-Carr Fastener Corp., Cambridge, Mass. Affiliates: Cinch Manufacturing Corp., Chicago, Ill., and Ucinite Co., Newtonville, Mass.

Products: Printed circuit boards; radio, television and electronic components; washers and small metal stampings.

Facilities: Total floor area is almost 90,000 sq ft, including over 67,000 sq ft for manufacturing, 950 for engineering and 150 for laboratory. Employees number 292. Inspection equipment includes salt-spray cabinet, Rockwell hardness tester, comparator, bond strength test set-up for printed circuits, high potential testers, socket insertion and withdrawal test machine, and a variety of electronic test equipment.

R & D: Development projects related to the above product areas can be undertaken with present staff and facilities.

Universal Wire & Cable Co. Ltd., 2155 Moreau St., Montreal, Que. LA. 6-2533. L. Finkelstein, plant engineer.

Affiliate: Asco Wire & Cable Co., Bridgeport, Conn.

Products: Round copper magnet wire insulated with a baked coating as used in electro-magnetic coils. Insulation types presently being applied include enamel, formex, polyurethene and textiles. Sizes range from 19 to 40 AWG.

Facilities: Two buildings, total 3,000 sq ft, equipped with copper rod and wire drawing machines, enamelling ovens and general machine shop. Full range of quality control equipment and procedures.

Valeriote Electronics (Guelph) Ltd., 3 Victoria Rd. N., Box 356, Guelph, Ont. TA. 4-3220. M. Valeriote, president.

Products: Coils, chokes, transformers, brackets, installation kits, aluminum and fiberglas masts, fiberglas insulators, antennas, suppressors, filters, delay lines, transmitters, remote control units, power supplies, and audio amplifiers. Antennas have been produced for various frequencies and up to 200 ft high and 600 ft long, including the Decca system along the coasts of Nova Scotia and New Brunswick.

Facilities: House and barn were converted into offices and factory. A new steel building is just being completed, 7,700 sq ft, with wide range of production equipment to match the items listed above. Also adequate electrical and electronic test and inspection equipment. Employees number 18, including 12 in engineering department.

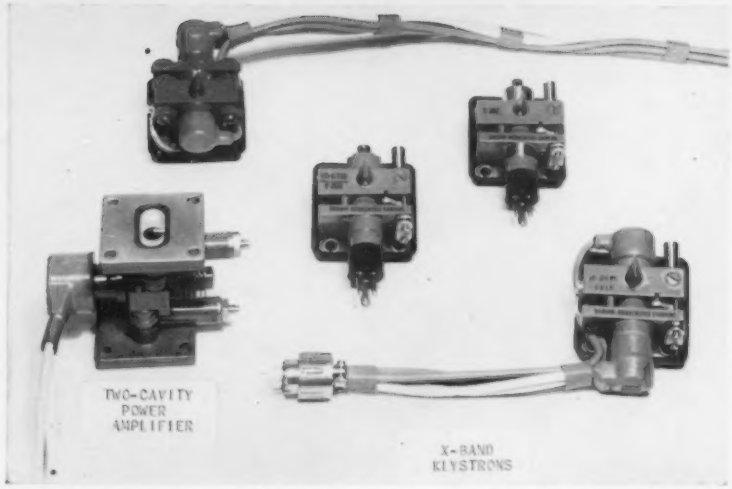
Varian Associates of Canada Ltd., 45 River Dr., Georgetown, Ont. TR. 7-3664 & Toronto EM. 3-3127. B. H. Breckenridge, president and general manager.

Parent: Varian Associates, Palo Alto, Cal.

Products: Klystron tubes, backward wave oscillators and amplifiers. At the present time the company is producing over 25 different microwave tubes (chiefly klystrons), and the facilities are such that it could develop and manufacture magnetrons, travelling wave tubes, TR cells, duplexers and microwave circuitry.

Facilities: One-story brick and steel building with slab roof, total 12,000 sq ft. (4,000 sq ft addition is being planned). Manufacturing equipment includes precision tool and machine equipment, test equipment for JAN production tests, complete plating equipment for precision plating, furnaces, etc. Separate inspection and test department equipped with precision measuring instruments suitable for quality control procedures on all phases of klystron production. Plant is fenced and protected with a 24-hour security guard service. All employees have been cleared to the category of Secret by DDP. Total staff of 47 consists of 1 manager, 7 technical personnel, 18 skilled and 21 unskilled personnel. All key engineering and production staff have attended training courses at the parent company's plant.

R & D: The engineering department is equipped for klystron and wave tube research and laboratory tube manufacture. Senior engineers include J. G. Matthies, scientific service officer with the Defence Research Board (1951-1955) and M. Viant, tube research engineer at E.M.I. Research Labs. (1949-1958).



X-band klystrons & two-cavity power amplifier — Varian Associates of Canada

Vector Labs. Inc., 736 Notre Dame St. W., Montreal 3, Que. UN. 1-6552. D. J. Rosenberg, manager.

Products: Special instruments and automatic controls for the measurement and control of all physical quantities, including electro-mechanical voltage regulators from 2 to 50 kva, single and 3 phase; line frequency monitors that actuate a relay if line frequency varies by more than preset amount; chopped light systems for photoelectric control and message transmission over line-of-sight distances. Equipped to produce packaged circuitry, special controls and control techniques, servo ac voltage regulators, power supplies, telemetering equipment and remote control equipment.

Facilities: Rented factory space of 1,000 sq ft. This accommodates a model shop, assembly and test area. Quality control ensures that all fundamental quantities are maintained within 0.1% of the prescribed standards. The small team of mechanical and electrical engineers, mathematician and theoretical physicist has had over 50 years of combined experience in the design and development of special instruments and automatic controls.

R & D: Interested in undertaking development projects within the general categories outlined above.

The Wallace Barnes Co. Ltd., 274 Sherman Ave. N., Hamilton, Ont. LI. 5-1172. F. J. Beattie, sales manager and secretary. Second plant: Pointe Claire, Que.

Affiliate: Associated Spring Corp., Bristol, Conn.

Products: Compression springs, extension springs, torsion springs, electrical contacts, electrical switch springs, spring clips, fasteners, wire forms, rings, die springs, valve springs. Products previously made for the armed services include springs for rifles, machine guns, heavy guns, fuzes, aircraft, trucks, aircraft instruments, radio and navigation equipment, bomb sights, computers, torpedos and submarine detection equipment.

Facilities: Total of 106,000 sq ft in three buildings, one of sheet metal and two of brick and concrete. Equipment includes automatic spring coilers, 4 slides, foot and power presses, slitting machines, spot welders, plus facilities for hardening and tempering, shot blasting, tumbling and coil spring grinding. There is a fully equipped machine shop. Quality control department has facilities for testing coils and flat springs, statistical quality control and authorized R.C.A. inspection laboratory for testing wire and flat spring steel. The property is surrounded by a chain link fence and is equipped with Dominion Protective Alarms System. 135 personnel engaged in sales, administration, engineering and manufacturing management; also 225 production workers.

R & D: Moderate facilities for research and development at the Hamilton plant, plus complete access to the facilities of Associated Spring Corp.

Ward Leonard of Canada Ltd., 1070 Birchmount Rd., Box 70, O'Connor P.O., Toronto 16, Ont. PL. 7-4131. D. S. Brown, sales supervisor.

Parent: Ward Leonard Electric Co., Mount Vernon, N.Y.

Products: Vitreous enamel wirewound resistors, rheostats, relays, motor controls, theatre dimmers. Also act as sales representatives for a wide range of nickel cadmium batteries, emergency lighting units, electric switches, fractional hp submersible pumps, and regulated dc power supplies. Facilities for designing and manufacturing specialized control panels.

Facilities: One brick and concrete block building, 16,000 sq ft. Complete resistor winding, enamelling and test facilities, plus metal fabrication shop. Quality control section has complete test and inspection facilities for both government and industrial equipment. The total staff of approximately 40 includes 3 engineers, 1 inspection engineer, 1 industrial engineer doing quality control, and 7 sales representatives.

Welwyn Canada Ltd., 1255 Brydges St., London, Ont. GL. 1-9490. R. Wilton, vice-president and technical director.

Parent: Royal Worcester Ltd., Worcester, England. Subsidiary: Welwyn International Inc., Cleveland, Ohio.

Products: Range of high stability carbon resistors, fully approved under the various military specifications which pertain. These include both lacquer protected and insulated types. Miniature power type resistors are also in preliminary stages of manufacture; these range from 3 to 10 watts, are metal film types, and will be a replacement for cement-coated wirewound types. A miniature resistor designed for the computer field is also in prototype production; it will have better performance characteristics than composition equivalents. Because the company specializes, it confines its product line to the types mentioned.

Facilities: Brick and steel building, 7,000 sq ft, contains all operations of the company. Machines and facilities have been specialized to produce the types of products mentioned above. Quality control is maintained throughout all stages of manufacturing and there is a resident DND/IS Inspector. Protected by a 24-hour patrol and watchman service; security measures have been approved by DDP. There are approximately 60 personnel including management and technical staff.

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SIEMENS
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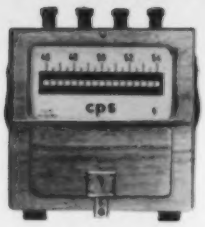

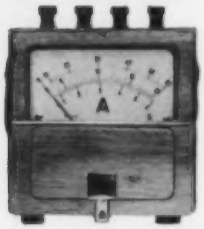

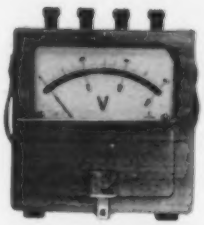

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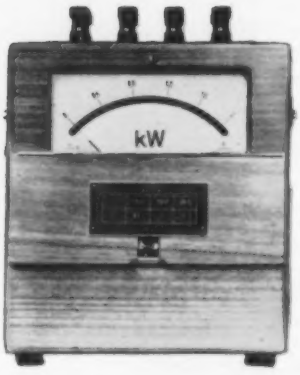

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New products

For more information on New Product items, use the Reader Service Cards on page 75 and 76.

101

Transparent potting compound 101

Dielectric Gel is a transparent silicone potting compound with a "memory." Test probes can be inserted right through the gel to test components. Once the probes are removed, the gel heals itself immediately. It has an initial viscosity similar to molasses but cures in place to form a resilient, clear mass. Curing time may be varied from 30 minutes to as much as 48 hrs at temperature ranging from 40 to 150 C. The material is resilient and stress-free throughout its operational temperature span of —60 to 400 F.

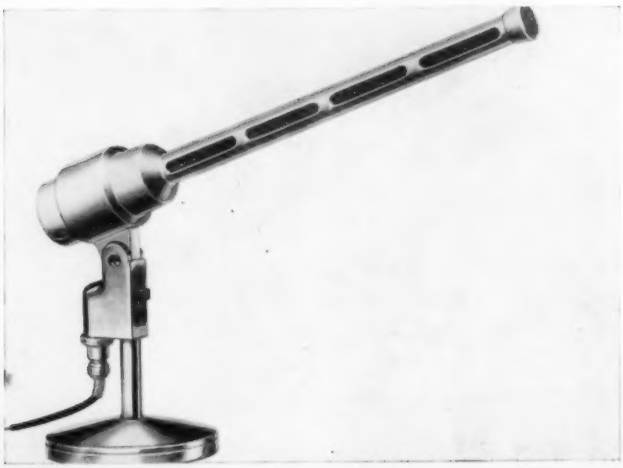
Dow Corning Silicones Ltd., Toronto.

102

Transistorized two-way radio 102

Transistorized progress line two-way radios are available in 10, 30 and 75 watt ratings. Only three tubes are used in lower wattage categories and four in the 30 and 75 watt models. To reduce power drain to a minimum the receiver is designed so the final transistors in the speaker operate only when a signal is present. On stand-by the 75 watt unit draws only 0.040 amps. The first production models will be for use in the 150-174 mc, narrow or wide band. All units are interchangeable for negative or positive ground with 12 or 24/12 volt power supplies. Two-frequency operation is a standard option.

Canadian General Electric Co. Ltd., Toronto.



103

Directional microphone 103

Sound spot microphone model 644 uses a combination cardioid and distributed front opening, enabling it to maintain proper response far away from the sound source. Its front effective acceptance angle is 45 deg. on each side of centre. Random noise cancelation from the rear and sides exceeds 20 db. Frequency response is from 40 to 12,000 cps. Weight is 2 lb. 9 oz.

E-V of Canada Ltd., Scarborough, Ont.

Tube tester kit 104

Available in either kit form or wired and calibrated, the Starkit model 9-99 dynamic trans-conductance tube tester kit is designed to test tubes under dynamic conditions. Tubes are tested for

opens, shorts, leakage, heater continuity and quality. Fourteen separate filament voltages for .75 to 117 volts are available. It is equipped with 10 five-position lever switches, 4½ in. meter with "Replace-Good" scale and a roll chart containing the necessary tube data. Each kit is housed in a hardwood case with detachable lid and is supplied with French/English assembly and operating instructions.

Stark Electronic Sales Co., Ajax, Ont.

Potentiometer field tapping kit 105

To provide versatility in prototype development work, this kit permits installation of potentiometer taps in the field. Included in the kit are a tap setting fixture, two screwdrivers and a pair of tweezers. These items, plus a quantity of basic potentiometers and tap assemblies, make it possible to prepare a variety of potentiometers that meet any on-the-spot requirements quickly.

Atlas Radio Corp. Ltd., Toronto.

Microwave absorber 106

Guaranteed at minus 40 db reflectivity level for the appropriate frequency band, this microwave absorber material is available in 6 inch and 9 inch thicknesses. Eccosorb CV-6 is for use in the 5.5 kmc through 50 kmc range, and Eccosorb CV-9 is designed for the 2.5 kmc through 50 kmc range. The material is supplied as lightweight, flexible, fire-retardant foam product. It is a bulk resistive foam manufactured from polyurethane resins, by Emerson & Cuming, Inc.

M. J. Howard Co. Ltd., Ottawa.

Photo-recording paper 107

Two new papers have been introduced for photo-recording in oscillograph instruments. Limagraph 77 has a relative tungsten speed of 100 and orthochromatic emulsion that records sharp black traces at writing speeds to 50,000 ips. Wide exposure latitude permits medium-speed recording.

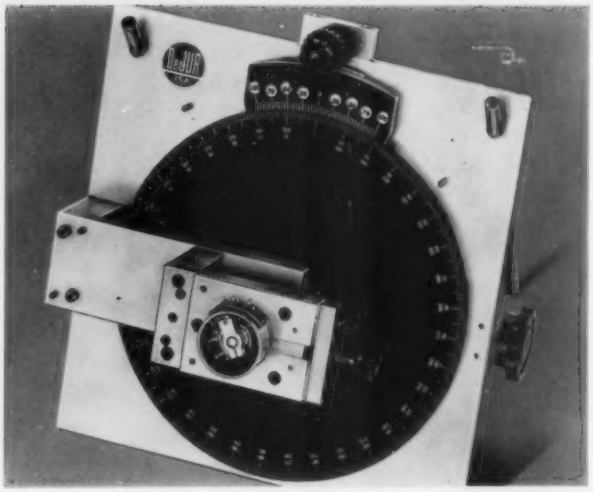
Linagraph 44 has a relative tungsten speed of 20. It is designed to produce high trace density and contrast from low to relatively high writing speeds. Maximum average thickness of the paper base is 0.003 inch. The papers are suitable for conventional or stabilization processing. CEC Datarite processing can be used for Linagraph 44 paper.

Canadian Kodak Sales Ltd., Toronto.

Vidicon tube 108

High-sensitivity vidicon tube, type WL7325 has been developed for televising scenes over a wide range of illumination levels. When operated under recommended conditions the tube is capable of resolving detailed information equivalent to 600 television lines. The main characteristic of the tube is its ability to produce satisfactory pictures with an average illumination as low as one tenth of a foot candle on the faceplate. With an inexpensive lens, useful pictures can be obtained from scenes having a highlight brightness of less than five foot lamberts.

Canadian Westinghouse Company Limited, Hamilton.



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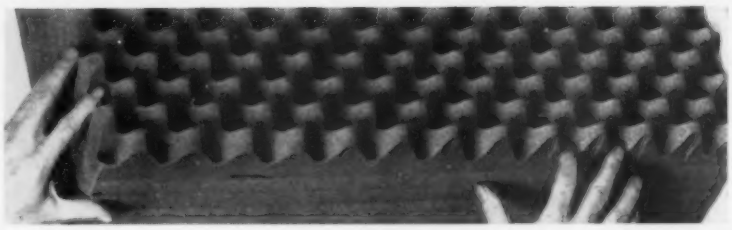
106



Teflon insulated terminals 110

For use under severe conditions of humidity, terminals 1945, 1946 and 1947 have a double turret type solder terminal securely seated in Teflon. They are available with three types of mounting studs: external threaded, rivet type, and internal threaded. External threaded and rivet type terminals are 9/16″ high when mounted; internal threaded types are approximately 5/8″ high. All three types are approximately 3/8″ in diameter. External threaded types are available with 1/4″ or 3/8″ shanks. Rivet types are available in six shank lengths for mounting on panels 1/32″ to 1/8″ thick. Internal threaded types are available with #6-32 thread or #4-40 thread.

Cambridge Thermionic of Canada, Ltd., Montreal.

Regulated dc supplies 111

Sorensen miniature transistorized regulated dc power supplies operate from 115 vac, 50-60 or 400 cps. They wire into the circuit like conventional potted transformers or chokes. For 50-60 cps input, thirty-six models cover nine output voltages, ranging from 3 to 36 vdc in approximately 14% increments, with output power capacities of 2, 4, 8 and 15 watts. A like number of models for 400-cps input is available. Voltage regulation is ±0.05% against line and load variations and ripple is less than 0.01%

Bayly Engineering Ltd., Ajax, Ont.

Resistance modules 112

Consolidated Resistance Co. R-Stacks make it possible to assemble a variety of reference standards, trimmers, voltage dividers and special resistance combinations. The individual resistance units are available in a variety of resistance value, but each is physically designed so that it can be assembled on a common mount with terminations to provide the desired resistance value. Adjustment range is 0.1 ohm to 1 megohm. Resistance accuracy is 0.005%.

E. E. Whittaker, Ottawa.

Microwave power meter 113

FXR, Inc., has introduced an instrument which measures the power of microwave signals using a sensing element only fifteen thousandths of an inch in diameter. Power measurements are made by calibrating the heat generated in the sensing element and canceling out ambient temperatures measured with a second and identical element. Accuracy is claimed even in the 10 microwatt power range.

Radionics Ltd., Montreal.

(Continued on page 67)

Tarzian

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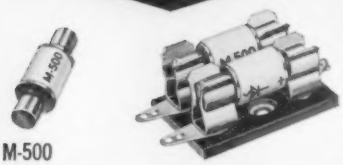
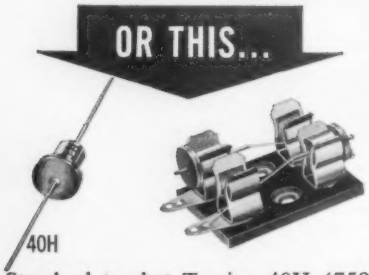


M-500

The cartridge-type Tarzian M-500 (500 ma) snaps into popular fuse holder brackets.

OR THIS...



40H

Standard top-hat Tarzian 40H (750 ma) is directly interchangeable where a metal case is required.

OR THIS...

F4

Tarzian F4 (750 ma) insulated case tucks in out of the way against chassis. Leads are solder type.

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Ontario Hydro takes options on land for CANDU site

The Hydro-Electric Power Commission of Ontario has already taken out options on prospective sites in Western Ontario for Canada's first full-scale nuclear power generating station.

Known as CANDU (Canadian deuterium uranium), the power station will produce 200,000 kw of electricity and will use a natural uranium — heavy water system. It will be a joint project, with Atomic Energy of Canada Ltd. providing most of the design and the equipment. Ontario Hydro, in addition to aiding in the design, will provide the site, co-operate in the construction, and operate the station as a unit in its power distribution system.

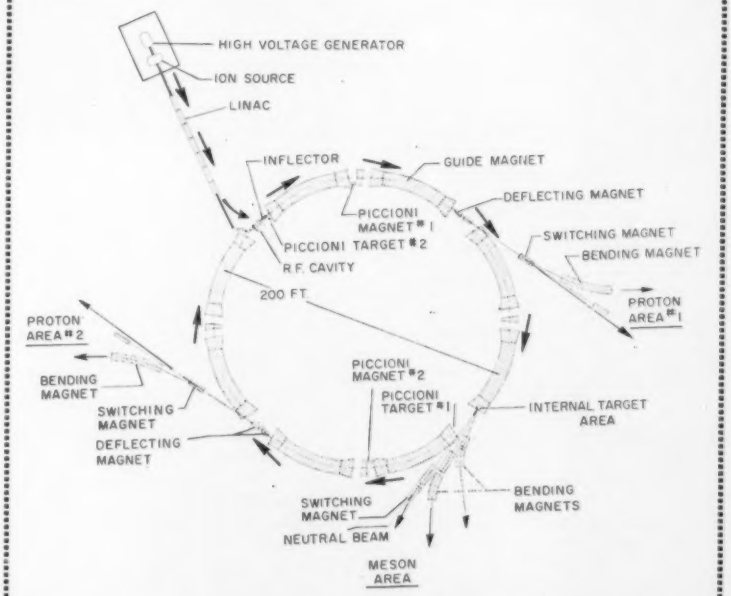
The plant will cost an estimated $60,000,000, exclusive of design and development costs, and could be in operation late in 1964 or early 1965. On the basis of present knowledge, it is expected that the cost of the electricity generated by this new station will be about six mills per kilowatt hour. This makes it competitive with other forms of thermal power generation.

IAEA fosters exchange of thermonuclear knowledge

The scientific advisory committee of the International Atomic Energy Agency (IAEA) held its second series of meetings in Vienna last month to consider several aspects of the Agency's scientific program, including the proposed conferences, symposia and seminars for 1960, scientific and technical publications, and the research contracts which had been or were to be awarded by the Agency.

One topic of great interest to the electronics field was consideration of the possibility of a project for an exchange of knowledge on controlled thermonuclear fusion. Work on controlled fusion and plasma physics has been proceeding at several research establishments in different countries.

In 1958 Geneva conference provided an opportunity for an exchange of some information on this subject, but in view of the rapid pace of research and development, it might be useful to devise some method of exchange of knowledge on a continuing



Plan of 12.5 BeV zero gradient synchrotron for Argonne National Lab.

basis. This would be of special interest for smaller countries starting work in this field.

Dr. W. B. Lewis, vice-president, research and development, Atomic Energy of Canada Ltd., has been elected vice-chairman of the scientific advisory committee.

Zero gradient synchrotron

Construction of a 12.5 BeV zero gradient synchrotron (ZGS) was started last month at the Argonne National Laboratory near Chicago. The $29,000,000 machine is expected to go into operation early in 1962.

ZGS will be housed in a ring-shaped building 200 feet in diameter. In operation, protons will first be accelerated to 800 kv by a standard high voltage source. From there they go into a linear accelerator where they attain 50 MeV before being introduced into ZGS in short, regulated bursts. The particles can be directed into experimental areas at any time after their entrance in the ZGS.

The machine will serve two basic purposes: provide a wide variety of subatomic particles, and provide a means of studying these particles.

ZGS will be used to produce all the 30 presently known or anticipated particles. Because it will be able to produce relatively large quantities of the particles, it will be possible for the scientists to undertake experiments involving rarely occurring particles.

A number of scientists from midwestern U. S. colleges and universities, as well as those from Argonne, are expected to use the machine.

Manual on radiation protection

A comprehensive handbook of internationally compiled recommendations for users of radioisotopes has been published by the International Atomic Energy Agency, Vienna.

The "Manual of the Safe Handling of Radioisotopes" covers organizational, medical and technical aspects of safety practices. Published in English, it is available from IAEA at about $1.00.

The recommendations have been prepared by a panel of 13 experts from ten countries under the chairmanship of Professor Gunnar Randers of Norway. Their work is based on studies of existing manuals and regulations in use in member countries and on similar work already carried out by other international organizations on more limited aspects of the problem and on comments received from member governments.

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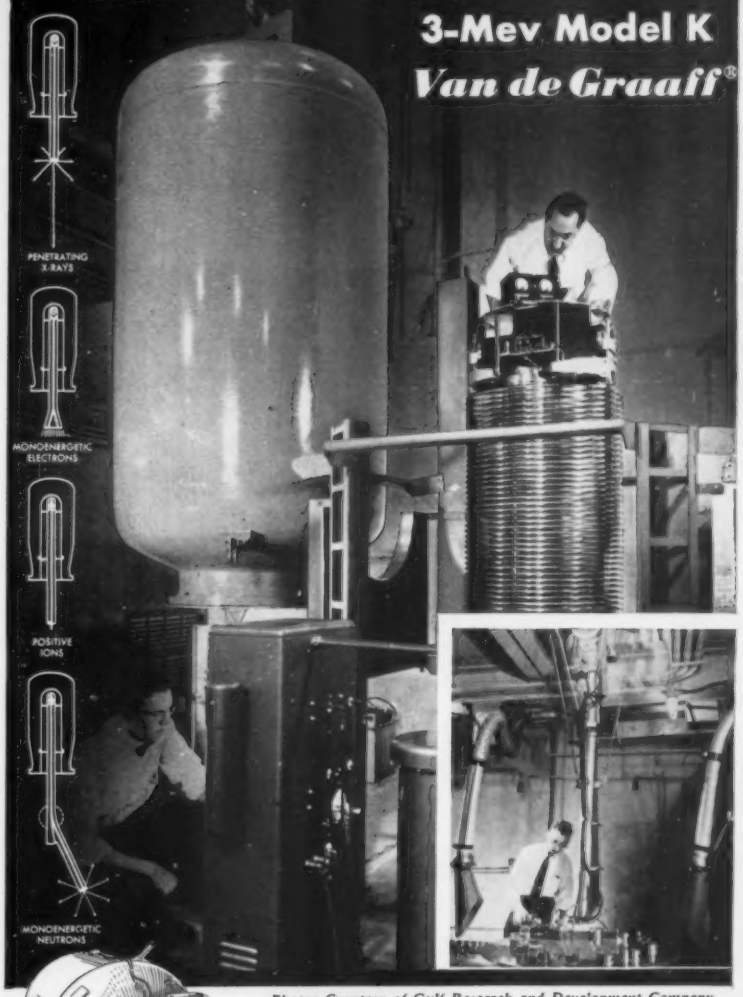
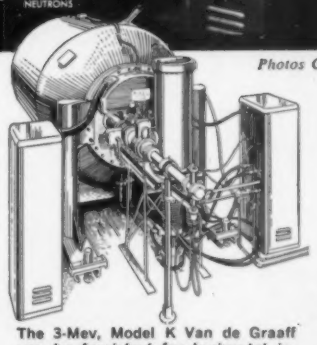


Photos Courtesy of Gulf Research and Development Company



The 3-Mev, Model K Van de Graaff can be furnished for horizontal installation as illustrated above.

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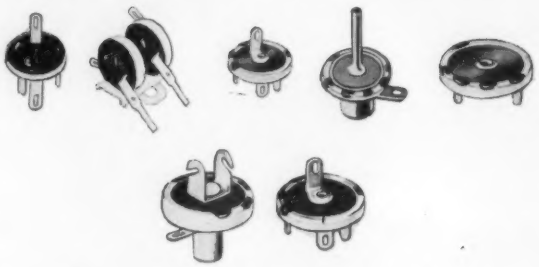

The ERIE BUTTON SILVER-MICA* capacitor has been and still is known to be the world's finest high-frequency capacitor. Since 1941, when Erie originally developed the Button capacitor, this compact, efficient unit has been the backbone capacitor of most military and communications equipments.

The ERIE BUTTON SILVER-MICA capacitor is composed of a stack of silvered mica sheets encased in a silver plated brass housing with the high potential terminal connected through the center of the stack. This compact design permits current to fan out in a 360° pattern from the center terminal. ERIE uses short-heavy terminals resulting in minimum circuit inductance. These design features make ERIE BUTTON SILVER-MICA capacitors **the best** for VHF and UHF applications. They are available in a wide capacity range, a variety of styles and sizes, and have many mounting arrangements.

ERIE BUTTON-MICAS are available which comply with or exceed all requirements of Mil C-10950-A.

Also available at ERIE are the BUTTON CERAMICONS which have the same mounting and terminal arrangements as the Silver-Mica capacitor. These units have a ceramic dielectric rather than the stacked sheets of silvered mica and may be used in applications where extreme temperature stability is not essential.

Write for complete description and specification.

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Defence contracts

Unclassified electronics contracts for $10,000 or more have been awarded to the following Canadian firms by the Department of Defence Production. A figure in parenthesis indicates the number of contracts, the amount being the total value.

May 16-31, 1959

Alpha Aracon Radio Co. Ltd., Downsview, Ont., equipment, $18,675.

Bayly Engineering Ltd., Ottawa, repair and overhaul of telecommunications materiel, $10,000.

Bayly Engineering Ltd., Ottawa, repair and overhaul of ground and airborne equipment, $133,610.

Bayly Engineering Ltd., Ottawa, repair and overhaul of aeronautical equipment, $10,000.

Canadian Aviation Electronics Ltd., Montreal, repair and overhaul of ground and airborne.materiel, $3,839,-370 (3).

Canadian Marconi Co., Montreal, sonobuoy equipment $11,074.

Canadian Marconi Co., Montreal, development contract, $23,950.

Collins Radio Co. of Canada Ltd., Toronto, repair and overhaul of equipment, $15,000.

Croven Ltd., Whitby, Ont., radio crystals, $39,200.

Domac Technical Sales Ltd., Ottawa, equipment, $12,055.

Dominion Bridge Co. Ltd., Montreal, sonar domes, $33,120.

Garrett Manufacturing Corp. of Canada Ltd., Rexdale, Ont., repair of ground and airborne materiel, $180,-000

Garrett Manufacturing Corp. of Canada Ltd., Rexdale, Ont., equipment, $14,528.

Instronics Ltd., Stittville, Ont., equipment, $69,674 (2).

International Business Machines Co. Ltd., Ottawa, rental of office machines, $126,261 (4).

Northern Electric Co. Ltd., Belleville, Ont., equipment, $32,804 (2).

Philco Corp. of Canada Ltd., Don Mills, Ont., technical services, $12,-219.

University of Saskatchewan, Saskatoon, research contracts, $49,940 (2).

June 1-15, 1959

Ampex American Corp., Ottawa, tape recorder units, $16,550.

Bayly Engineering Ltd., Ottawa, radio test sets, $16,925.

Bell Telephone Co. of Canada, Ottawa, technical services, $32,356.

Bell Telephone Co. of Canada, Ottawa, rental of telephone and teletype facilities, $19,000.

British Columbia Telephone Co., Vancouver, rental of telephone and teletype facilities, $17,000.

Canadian Aviation Electronics Ltd., Montreal, repair and overhaul of telecommunications materiel, $10,000.

Canadian Aviation Electronics Ltd., Montreal, fire control system spares, $1,855,000 (5).

Canadian Marconi Co., Toronto, tubes, $21,842.

Honeywell Controls Ltd., Toronto, oscillograph, $13,791.

International Business Machines Co. Ltd., Toronto, technical services, $13,488.

International Business Machines Co. Ltd., Ottawa, rental of office machines, $38,616.

Mel Sales Ltd., Arnprior, Ont., components, $12,283.

NSL Electronics (Canada) Ltd., Hamilton, Ont., technical services, $41,532 (3).

RCA Victor Co. Ltd., Montreal, research contract, $32,333.

RCA Victor Co. Ltd., Montreal, radar display equipment, $341,222.

Raytheon Canada Ltd., Ottawa, tubes, $164,231.

Sperry Gyroscope Co. of Canada Ltd., Montreal, radar test equipment, $41,654.

TMC Canada Ltd., Ottawa, equipment, $23,138.

New products—cont.

Aluminum coaxial plugs 114

Series TNC Coaxial RF plugs are now available in aluminum. Designation for the new series is ALTNC. Assemblies available in the new series include plugs and cable jacks for either RG-58C/U cable or ¼-in. Foamflex semirigid aluminum cable. Also available are adapters for matching the above two cable types to each other or to bulkhead fittings.

Cannon Electric Company, Toronto.

Stud-type terminal blocks 115

Kulka stud-type molded-barrier blocks are available in various sizes ranging from 1 to 26 stud posts, and in current handling ratings from a few milliamperes to 90 amperes. Screw studs are separated by molded barriers to minimize electrical leakage and shorts. Molded thermosetting plastics are used in accordance with the desired application or military specification.

A. T. R. Armstrong Ltd., Toronto.

(Continued on page 68)

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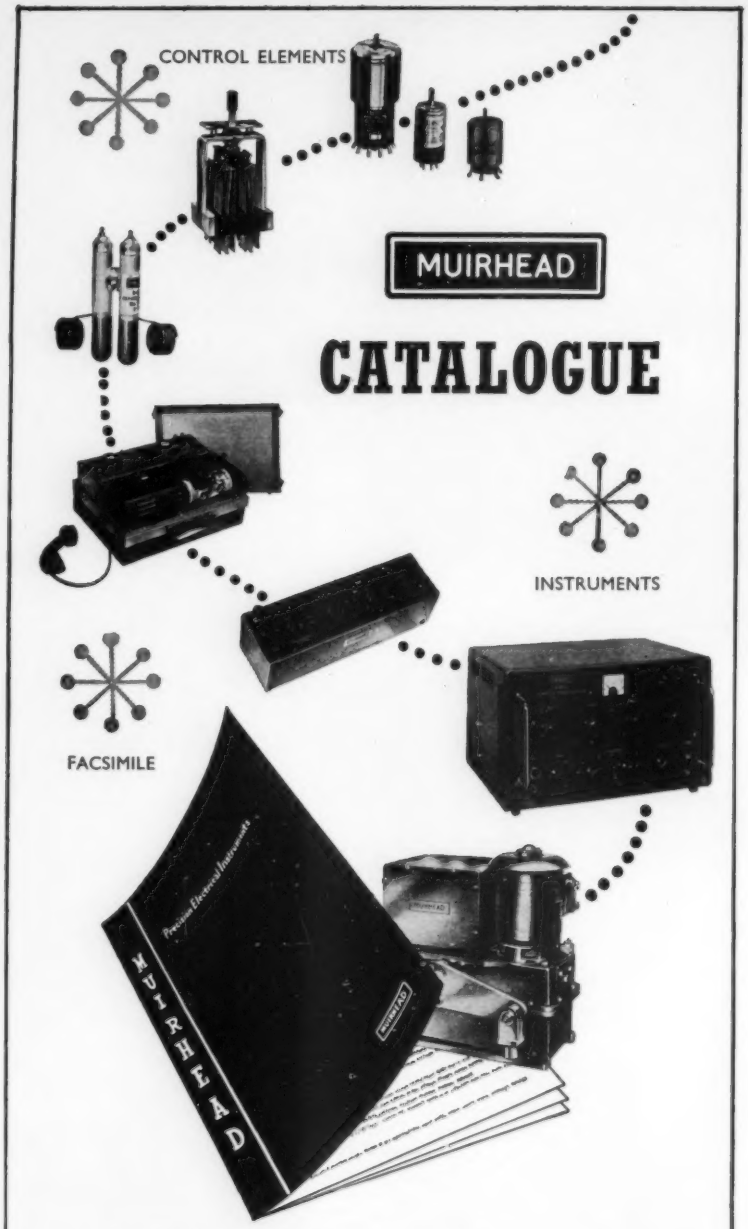

This 8-page abridged catalogue is intended as an introduction to the Muirhead range of precision products. It contains abridged specifications and descriptions of Muirhead Analysers, Oscillators, A.C. Bridges and associated equipment; Tuning Forks; Laboratory Equipment and Precision Components; Control Units and Facsimile Transmission Equipment.
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New products—cont.

High speed microfilm printer 116

Stromberg-Carlson model S-C 4020 microfilm printer is capable of plotting 15,000 graph points per second and of drawing axes, projecting grid backgrounds and printing vectors. The microfilming is accomplished by combined use of a Charactron shaped beam tube and a 35 mm recording camera. The tube displays characters or graph points at the rate of 15,000 per second, and the camera photographs the information on the face of the tube.

Accessories offered include the F-40 automatic processing camera projector. This photographs the screen of the Charactron shaped beam tube, processes the film and projects the selected data on a screen in the console. Delay time for this operation is only 10 seconds.

Another accessory is the F-60 form projector. With this unit, a business form may be superimposed on the recorded data, precluding the necessity of repeatedly programming the form into the computer.

Hackbusch Electronics Ltd., Toronto.

Rack and panel connector 117

Deutsch DRS series of rectangular rack and panel connectors have snap-in contacts and crimp-type terminations. Available in 49 and 99 contact sizes (with #20 contacts), these spring-mounted connectors for module units are self-aligning up to 1/32 inch misalignment in either the drawer or the panel mounting. No guide or stop-pins are required. Mating is assured by simply ramming the drawer home. The connector is designed for operation up to 110,000 feet at temperatures of from —70 to +392F.

Brian Engineering Ltd., Montreal.

Electronic voltmeter 118

The Bruel & Kjaer electronic voltmeter type 2409 can be used in the frequency range 2 cps to 200 kc and within the voltage range from about 1 mv to 1,000 volts. It has two voltage scales with full deflection for 10 volts and 31.5 volts respectively. A db scale is provided and when used in connection with the calibrated attenuator, any voltage measured may be read directly in db relative to 1 volt. For measurements on telephone lines, etc., a dbm scale is supplied with a reference value of 0.775 volts corresponding to 1 milliwatt in 600 ohms. The instrument can be used to measure peak, arithmetic average and true rms value of the input signal.

R-O-R Associates Ltd., Don Mills, Ont.

Tube tester 119

Jackson Electrical Instrument Co. tube tester model 648R has the tube sockets grouped on a separate panel. If the sockets become damaged after extended

use the entire panel may be replaced. The roll chart is located at the top of the instrument so that it will not be obscured by the operator's hands during operation. Little-used and obsolete tubes are listed in a separate book to give a shorter, more easily used roll chart. New tube data is published monthly.

Canadian Marconi Co., Electronic Tube and Components Div., Toronto.

Wave analyzer 120

Hewlett-Packard Co. model 302A wave analyzer is completely transistorized and operates from 20 cps to 50 kc. The instrument separates an input signal into its individual components so that the fundamental, harmonics and intermodulation products may be separately measured and evaluated. It may also be used as a narrow-band tuned voltmeter which will read absolute or relative levels.

Atlas Instrument Corp. Ltd., Toronto.

Pocket multimeter 121

Designed for versatility, Starkit model TM-7 pocket-sized multimeter weighs 14 oz. and has a sensitivity of 20,000 ohms per volt dc and 10,000 ohms per volt ac. It measures ac volts from 0.1 to 1,000; dc volts from 0.1 to 1,000; dc current from 1 ua to 500 ma; resistance from 1 ohm to 60 megs. It incorporates a printed circuit lever wiper switch, 3 in. meter, movement magnifier, recessed ohms adjust, and printed circuits throughout.

Stark Electronic Sales Co., Ajax, Ont.

Beta detector 122

Philips low level beta detection system can be used to check trace amounts of radioactive contamination. It will detect strontium 90, carbon 14, plutonium 32, etc. The system consists of an anticoincidence lead castle assembly, thin end window Geiger tube, guard counter tube, predetermined count scaler and power supply.

Philips Electronics Industries Ltd., Toronto.

(Continued on page 70)

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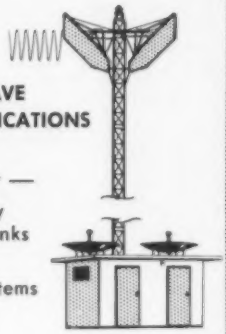

Studio transmitter —
Community antenna links
Common carrier systems

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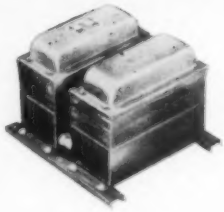

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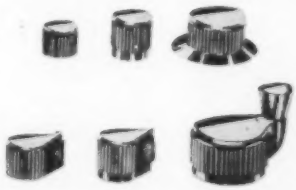

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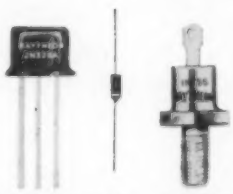

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New products—cont.

Re-entry connector contact 123

U.S. Components, Inc. REMI re-entrancy miniature contacts can be removed or replaced easily with pliers or by hand. They employ metallic sleeves with long cantilever springs to ensure ease of insertion, withdrawal and operational stability. The metallic sleeve design permits interchangeability of male and female contacts at all times.

J. J. MacQuarrie, Toronto.

Fungus-resistant vinyl insulation 124

Transparent, fungus-resistant vinyl insulation sleeving, designated resinite EP-69C conforms to the requirements of Navy specification MIL-I-631C, grades a and b, for electrical insulation applications. It is a clear vinyl with a low-temperature flexibility to —75 F, high-temperature stability to 185 F, and dielectric strength to 900 volts per mil of wall thickness. The material also is self-extinguishing in six seconds.

Borden Chemical Co. (Canada) Ltd., West Hill, Ont.

Tube-transistor bridge 125

Type 1661-A is a direct reading, dual-purpose v-t bridge with an amplification factor range of 0.001 to 10,000. It can be used to measure low frequency dynamic coefficients of both tubes and transistors over wide ranges. The bridge, designed to operate in the 270-400 cps or 1000-cps frequency range, makes use of ac null-measurement techniques, with consideration to phase shift and capacitance errors to ensure a wide operating range.

Independent v-t measurements can be made on forward and reverse voltage-amplification factor, resistance and transconductance. Thirteen adaptor plates are available for plugging in tubes and transistors of various configurations.

General Radio Co., Toronto.

Solid state relay 126

Trepac model 530-B solid state teleprinter relay has been designed as a replacement for conventional polar relays in all teletypewriters. The design utilizes silicon diodes and transistors to perform

the switching functions. It has a purely resistive input and will operate over a temperature range of —20 C to +71 C.

Tele-Radio Systems Ltd., Toronto.

25-watt marine radiotelephone 127

Spilsbury & Tindall marine radiotelephone model MRT-200 has been approved by the Department of Transport under Specifications 112 and 110. A land version of the set has been approved under Specification 116. The over-all versatility makes it suitable for land, marine or mobile use. MRT-200 has approximately 25 watts of power, five channels, broadcast band, and is available for operation on 12 vdc, 32 vdc or 115 vac. Power supplies are plug-in and instantly interchangeable. A feature that facilitates installation, tuning and inspection is the rotating chassis suspension. Cabinet size is 11 x 11 x 15½ in.

S & T Sales Ltd., Vancouver.

Printed circuit resistor 128

Type PC5, a low operating temperature, 5 watt resistor, has been designed for printed circuit use. The resistance element is wound on a fibre glass core, then sealed in a rectangular ceramic case. Leads have been alloy coated for positive soldering.

Renfrew Electric Co. Ltd., Toronto.

High-speed tape perforator 129

Punching speed of forty columns per second can be obtained on this tape perforator. It features four-way staggered positioning of the punching electro-magnets to provide compactness and maximum force. Rapid response to punching signals is obtained by an overlap. As the drive shaft completes 180 deg. of the complete revolution required to punch each column, the perforator will accept the signal from the next column to be punched. Safety features include an interlock to prevent the feed from advancing tape until a column has been punched. A visual alarm indicates low tape supply.

Standard models will accept any tape size up to one inch width, and any code column to 8 channnels. Tape width may be changed easily and special models capable of punching up to 30 channels are available upon request.

Telecomputing Corp., Los Angeles, California. END

How to trip a relay*

WITH A WEE PULSE

The technique of operating relays by direct application of pulses is nowhere near as widely used as (we think) it should be. This method lets you keep relay energy consumption and power supply drain down to a bare minimum — particularly if bi-stable polar relays are used. When you combine pulse operation with magnetic latching, no continuous coil current is needed to keep the relay contacts closed. Of course we have an ax to grind in that there are now no less than six* series of Sigma polarized, magnetic latching (Form Z) relays which can operate on single pulses. The newest of these is the subminiature Series 32 — which, when operated in this power-pinching way, could be just what you've been looking for.

Series 32

Here are some of the "high spots" in the technique of transferring the armature from one contact to the other with minimum energy. Ideally, the armature should arrive at the center of the air gap with zero velocity, whereupon the magnetic field can take over. A current pulse that starts out at trip value and decreases linearly to zero as the armature reaches the midpoint could do this (fig. 1), but the inductive relay coil makes such a pulse circuit impossible.

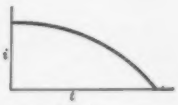

Fig. 1

However, similar waveforms can be approximated by a capacitor-stored pulse discharged into the relay coil. Although there are several fundamentally similar ways of doing this, one circuit (fig. 2) wastes no energy in a resistor and permits the relay to take a round trip operation on a single slug of energy from the source.

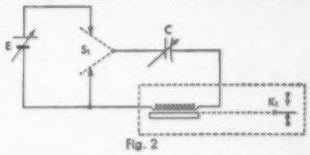

Fig. 2

As you get deeper into this business, it turns out that at least two quantities must be known to apply this method: the "pulse constant" in microjoules per mw. of relay sensitivity, and the "matching constant" in microseconds. A technical paper discussing all of the foregoing in some detail (presented at the recent NARM Conference), pulse application data, Series 32 bulletin, etc. are available on request. Ask for the special "Pulse Packet", handsomely bound in a manilla envelope.

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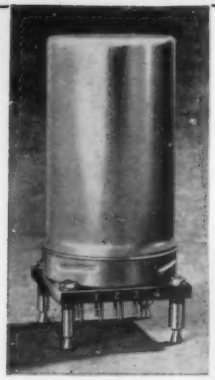

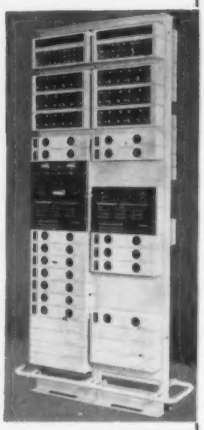

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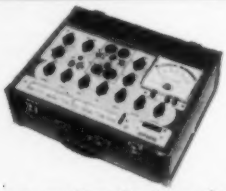

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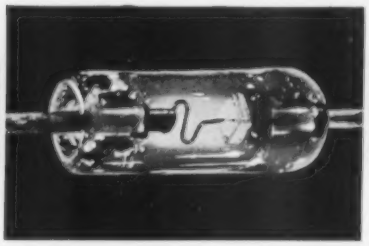

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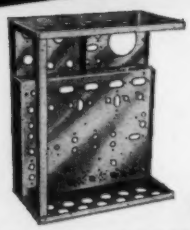
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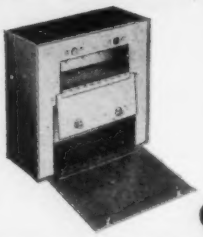
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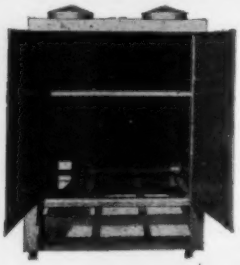
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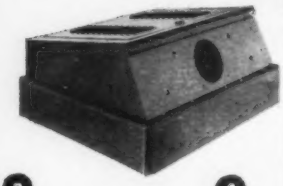
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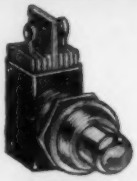

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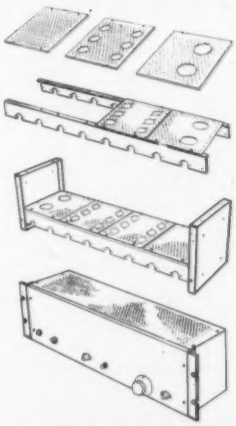

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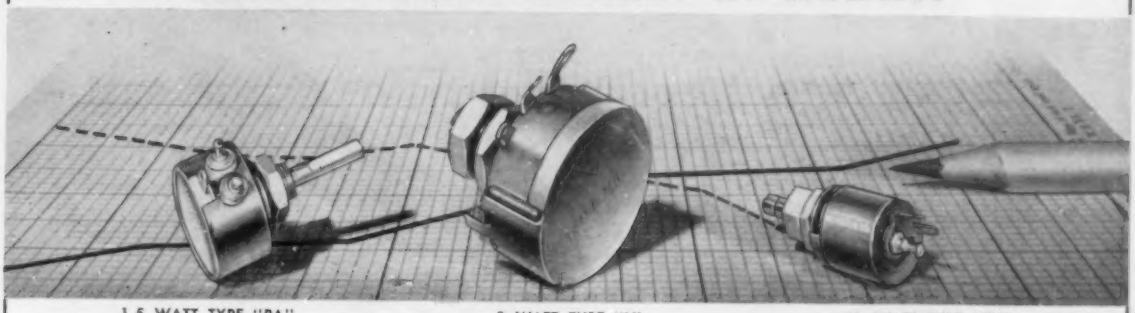

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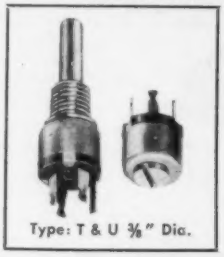

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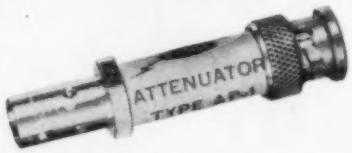

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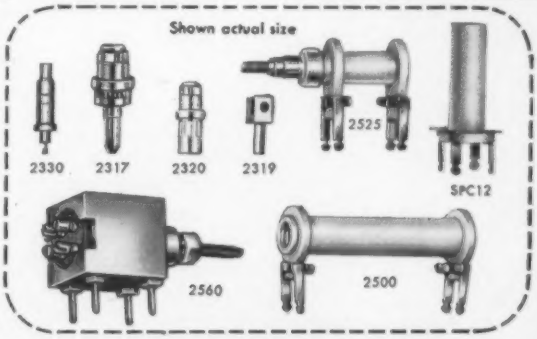

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Scientists and businessmen met in Ottawa recently to arrange for manufacture of NRC's analytical plotter. From left: S. J. Friedman of Ottico Meccanica Italiana, P. A. Dennis of Bendix Corp., Dr. G. Parenti and Dr. U. Nistri of Nistri Corp., U. V. Helava and T. J. Blachut of National Research Council.

Electronic computer plots maps from aerial photographs

U. V. Helava, a young Finnish-born scientist working in the photogrammetric section at the National Research Council, Ottawa, has invented an instrument for mapping from aerial photographs which is based on a new principle.

The instrument uses electronic computations in plotting maps from aerial photographs, instead of the optical projections so far used. The plotter is the first to use this principle, and is regarded as a major contribution to the technique of photogrammetry.

Instead of using mechanical parts, precise corrections are made by electronic computation for all the known errors involved in mapping.

W. J. M. Moore of the council's radio and electrical engineering division designed the electronic part of the plotter.

Licensed by NRC, the analytical plotter is to be manufactured in Italy, with funds provided by the U. S. Air Force.

New exhibitors take space for IRE exposition

Present bookings for space at the Institute of Radio Engineers' 1959 Canadian Convention and Exposition indicate that the number of participating firms and institutions will exceed last year's 152. About 85% of the booth space has been taken so far.

While the majority of exhibitors have been with the show in previous years, there will be some new names there this year. The Electronic Industries Association of Canada and the Canadian Radio Technical Planning Board will each have displays showing the invaluable roles they play in Canada's electronics industry.

Space research projects of the U. S. Army will form part of the Canadian Astronautical Society's exhibit of space equipment. It will include duplicates of the "talking" and cloud cover satellites launched earlier this year, solar cell assemblies and other electronic equipment used in space exploration.

Space has been reserved for a number of overseas scientific agencies who have been invited to exhibit equipment used in headline electronic and nucleonic projects. This includes an invitation to the U.S.S.R. to display examples of their achievements in electronics. As yet, however, plans have not been established, but a number of countries and organizations have expressed keen interest.

A full program of 119 technical papers has been established, and it is expected that a number of scientists from other countries will participate in the sessions. In addition, special programs are being arranged for delegates' wives and other ladies attending the convention.

New IRE subsection elects officers

At its first meeting, members of the South Western Ontario subsection of IRE elected W. Ruse of Bell Telephone Co., Windsor, as their chairman. They also elected R. A. Clark of CBC as vice-chairman, and G. L. Virtue of CKLW-TV as secretary-treasurer.

The new organization was granted a charter in January as a subsection of the London, Ont. section. There are about 50 members representing Essex, Kent and Lambton counties.

COMING EVENTS

August

18-21 WESCON: Western Electronic Show and Convention. San Francisco, Calif.

26-Sept. 5 26th National Radio and Television Exhibition, Earls Court, London.

31-Sept. 2 Metallurgical Society of AIME conference on properties of elemental and compound semiconductors, Boston.

September

21-25 Annual conference and exhibition, Instrument Society of America. Chicago.

23-25 Technical Conference on Non-Linear Magnetics and Magnetic Amplifiers. Washington, D.C.

28-30 National Symposium on Telemetering. San Francisco, Calif.

October

5-7 Fifth National Communications Symposium, Utica, N.Y.

5-9 Eleventh Annual Convention and Prof. Equipment Exhibit, Audio Engineering Society, New York.

7-9 IRE Canadian Convention, Exhibition Park, Toronto.

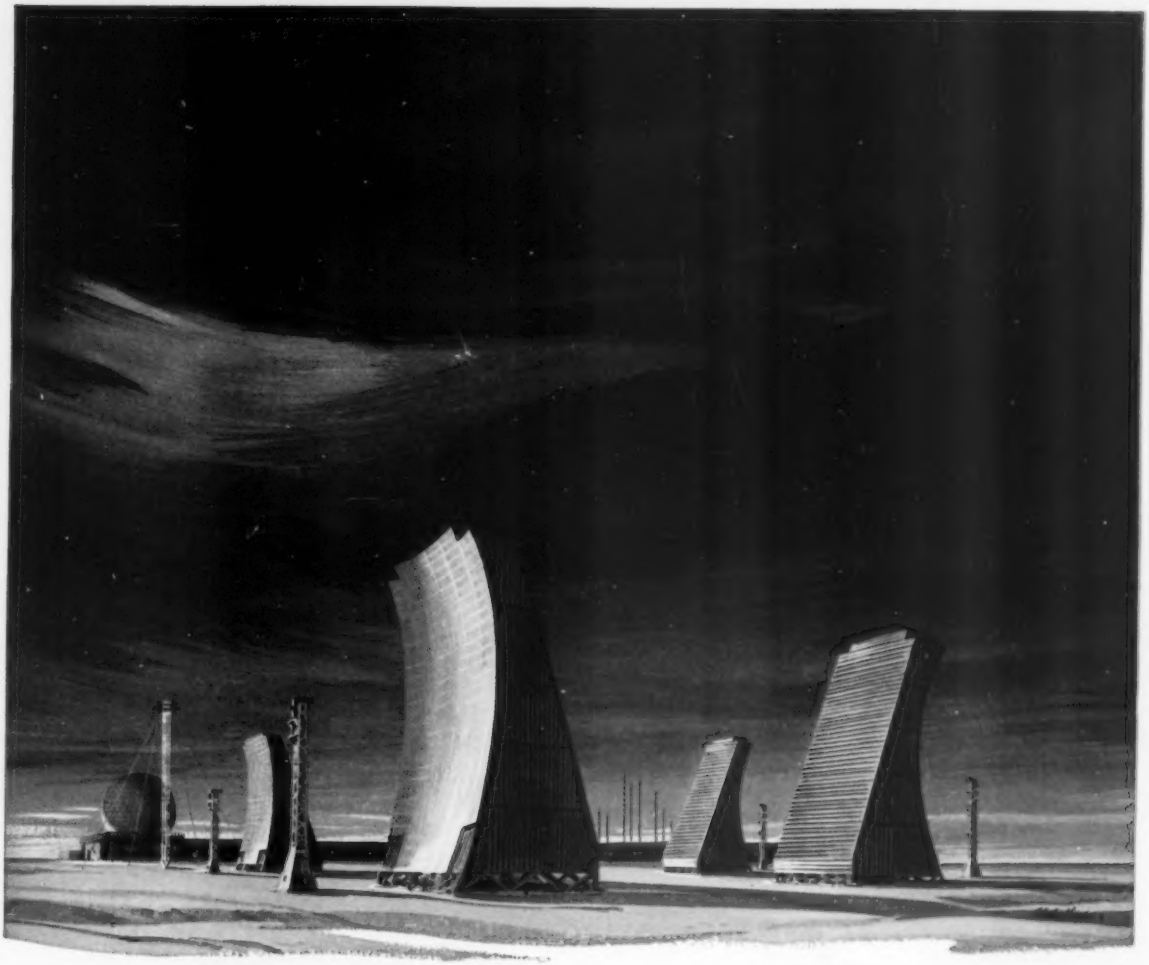
12-14 1959 International Systems Meeting of the Systems and Procedures Association of America, Toronto.

Charts aid design of comparators

One of our favorite authors, Maurice Price, has come up with another well-written and very useful paper, complete with charts, for the design of potentiometer position comparators. His story will be presented in the September issue of CEE.

George France, an engineer with Bach-Simpson Ltd., recently investigated the characteristics of cadmium sulphide photocells available in Canada. He recorded all the information carefully and included it in a paper for the benefit of other design engineers.

The second in a series of company profiles will present many interesting and useful details about one of the companies manufacturing electronic components in Canada. September will feature Muirhead Instruments Ltd., Stratford, Ont.



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